

Screening Site Inspection Work Plan

**Mobile Waste Controls
Houston, Texas
TXD 988051652**

**Prepared in cooperation with the

Texas Water Commission
and
U.S. Environmental Protection Agency**

**Prepared by

Engineering-Science, Inc.
Austin, Texas**

October 1992

The preparation of this report was financed through grants from the U.S. Environmental Protection Agency through the Texas Water Commission

9351627



SCREENING SITE INSPECTION WORK PLAN

MOBILE WASTE CONTROLS

HOUSTON, TEXAS

TXD 988051652

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CONTENTS

	Page
Section 1: Introduction	1
Work Plan Overview.....	1
Site Objectives With Respect to the Preremial Process	1
Project Contacts	2
Site Contact.....	2
Section 2: Site Background and Description.....	3
Site Information	3
Waste Containment/Hazardous Substance Identification.....	3
Characteristics.....	3
Required Information (Data Gaps)	17
Groundwater Pathway And Targets.....	17
Characteristics.....	17
Targets.....	23
Required Information (Data Gaps)	24
Surface Water Pathway And Targets.....	28
Characteristics.....	28
Targets.....	31
Required Information (Data Gaps)	31
Soil Exposure Pathway and Targets.....	32
Characteristics.....	32
Targets.....	32
Required Information (Data Gaps)	32
Air Pathway and Targets.....	33
Characteristics.....	33
Targets.....	33
Required Information (Data Gaps)	35

Contents, cont.	Page
Section 3: Site Non-sampling Data Collection and Field Work	36
Personnel Requirements and Responsibilities.....	36
Community Relations.....	36
Work Plan Activities.....	37
Task 1: Nonsampling and Sampling	
Activities and Rationale.....	37
Source Hazardous Material/Contaminant	39
Groundwater Pathway.....	39
Surface Water Pathway	44
Soil Exposure Pathway	46
Air Pathway.....	48
Quality Assurance/Quality Control Samples	48
Task 2: Decontamination Procedures	49
Equipment Decontamination.....	49
Personal Decontamination	49
Task 3: Sample Shipping	49
References	51
Appendix A Preliminary Assessment Report	
Appendix B Health and Safety Plan	
Appendix C Quality Assurance Project Plan	
Appendix D Site Reconnaissance Checklist	

FIGURES

1	Site Location.....	4
2	Site Plan.....	6
3	Well Location	25
4	Site Drainage Route	30
5	Wind Rose.....	34
6	Proposed Groundwater Sample Locations	45
7	Proposed Soil and Sediment Sampling Locations	47

TABLES

1	Results of TWC Monitoring Well Sampling Program.....	8
2	Summary of Analytical Data Results.....	9
3	Summary of Analytical Data Results.....	10
4	Mobile Waste Controls	11
5	Mobile Waste Controls	12
6	Results of City of Houston Lake Sampling.....	13
7	Summary of Analytical Data Results.....	14
8	Summary of Analytical Data Results.....	15
9	Summary of Analytical Data Results.....	16
10	Summary of Well Construction Details for Monitoring Wells	19
11	Summary of Well Construction Details for Nearby Water Wells	20
12	Groundwater Population Target Calculations	26
13	October 1, 1985, Through September 30, 1987, TWC Water Quality Information for Segment 1102	29
14	Field Schedule	38
15	Proposed Samples to be Collected at Mobile Waste Controls.....	40
16	Sample Containers, Methods, Preservatives, and Holding Times for Soil/Sediment Samples	42
17	Sample Containers, Methods, Preservatives, and Holding Times for Aqueous Samples	43

SECTION 1

INTRODUCTION

Engineering-Science, Inc. (ES) has been contracted by the Texas Water Commission (TWC) to conduct a screening site inspection (SSI) at the Mobile Waste Controls site (EPA identification number TXD 988051652). This site is located on approximately 25 acres at 10000 Minnesota Street in Houston, Harris County, Texas.^(ref. 1) This work plan was prepared to describe the site reconnaissance and sampling activities which are recommended to be performed at the site.

WORK PLAN OVERVIEW

This SSI work plan was developed using the best available information obtained primarily through a review of the preliminary assessment report (PA) and a review of the analytical results of groundwater, surface water and sediment sampling performed by the City of Houston, the TWC District 7 office, and the Federal Deposit Insurance Corporation (FDIC). Some of the information included may be incomplete. Therefore, much of the planned activities described should be considered tentative. This plan will be modified as necessary based on the actual site conditions encountered.

Section 1 is this introduction. Section 2 is the site background and description, and Section 3 describes the site field work to be conducted. The PA, the health and safety plan, the quality assurance project plan, and the site reconnaissance checklist are presented as appendices A through D, respectively.

SITE OBJECTIVES WITH RESPECT TO THE PREREDIAL PROCESS

The preredial stage of the Superfund process involves an expanded PA and a site inspection (SI) stage consisting of an SSI and, if necessary, a listing site inspection (LSI). The activities described in this work plan are designed to fulfill the requirements for a focused SSI.

A PA has already been conducted on the site addressed in this work plan. In addition, groundwater, sediment and surface water sampling have been performed. The SSI will build upon data collected during the PA by collecting additional data through background information research and the collection of environmental samples to further characterize conditions at the site. Sampling conducted during the SSI will attempt to identify the types of contaminants present, if any, to assess whether a release of hazardous substances has occurred, look for evidence of actual

human and environmental exposure to contaminants, and determine whether a site will move forward to an LSI or be designated as "no further remedial action planned."

PROJECT CONTACTS

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SECTION 2

SITE BACKGROUND AND DESCRIPTION

SITE INFORMATION

The inactive Mobile Waste Controls site is located at 10000 Minnesota Street in Houston, Harris County, Texas, half a mile west of the intersection of Alameda-Genoa Road and IH 45.^(ref. 1) The geographic coordinates of the site are approximately 29°37'19" north and 95°13'59" west.^(ref. 1) As depicted in Figure 1, the site (Area A) is a maintained grass field transected by Windmill Lakes Boulevard with a fenced boat storage area along the western edge of the site.^(ref. 2) The site is bordered on the north and south by apartment complexes (Windmill Landing Apartments), to the west by Lake Westwind which serves as a local recreational area, and to the east by a vacant lot and a horse stable.^(ref. 1)

Based on a Harris County tax records search, the FDIC owns approximately 121.9-acres surrounding and including the site.^(ref. 3) The property is managed by Ameresco Management, Inc.^(ref. 3) During the late 1960s, the area was an active sand quarry.^(ref. 1) Five deep pits were excavated at the site; two large (1,000-foot diameter) and three small (300-foot diameter). Precipitation, surface water run off, and groundwater accumulation caused the two large and two of the small pits to become four small lakes.^(ref. 1) The fifth pit was used for disposal of wastes.

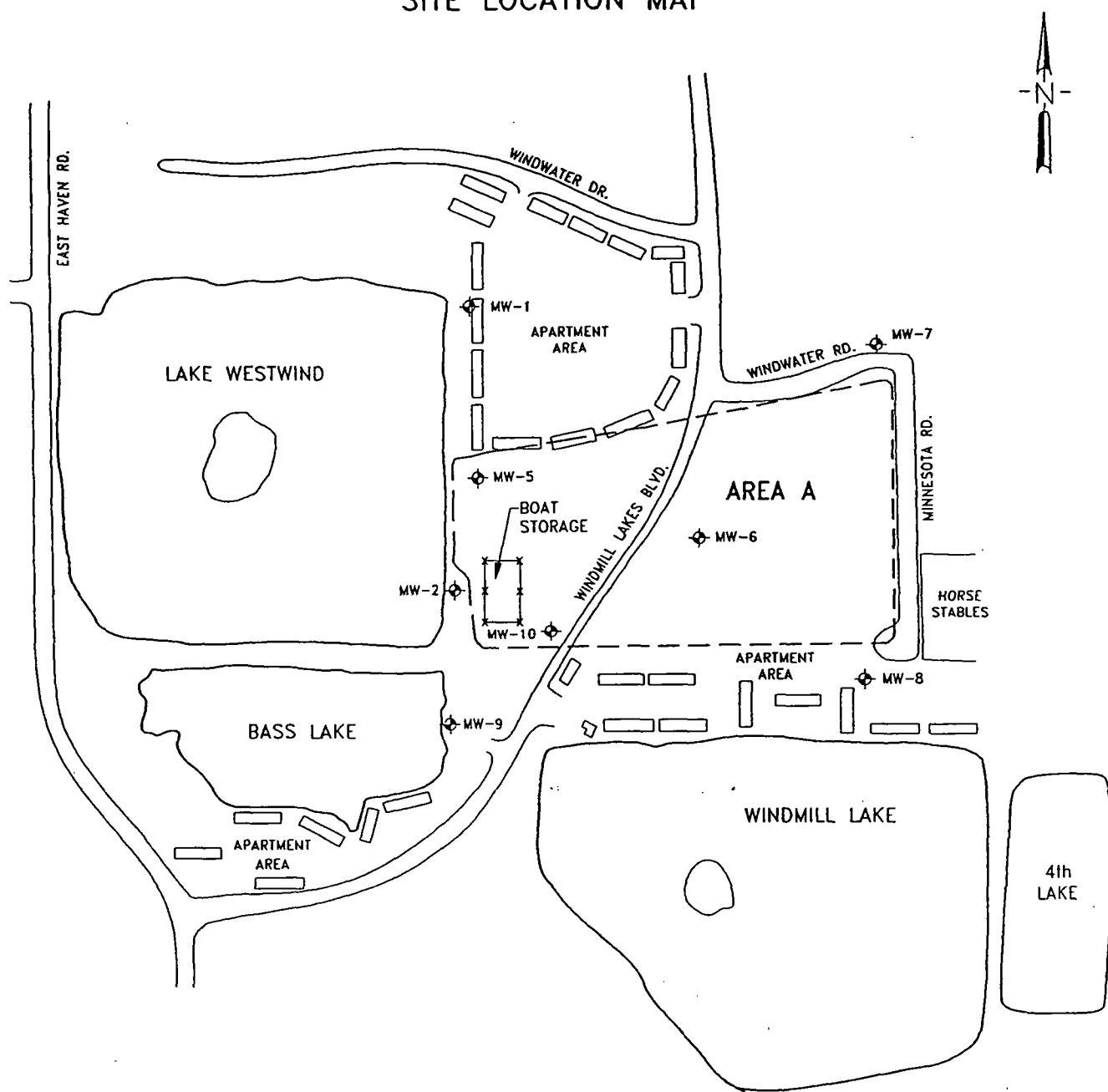
From 1969 through 1981, the property was owned by Realty Reclamation, Inc. and operated as an industrial and commercial landfill by Wallace Waste Control Company, Metropolitan Waste Conversion, National Disposal Contractors, and Mobile Waste Controls, Inc.^(ref. 1) In 1982, Levering & Reid created Windmill Lakes Subdivision and constructed three apartment complexes bordering the lakes. The PA, conducted on December 19, 1991, specified air, groundwater, surface water and soil exposure pathways of concern.^(ref. 1)

WASTE CONTAINMENT/HAZARDOUS SUBSTANCE IDENTIFICATION

Characteristics

By 1972, one of the small, unlined pits (Figure 1, Area A) had been two-thirds filled with industrial and commercial wastes.^(ref. 1) City of Houston representatives documented receipt of industrial chemicals, municipal and putrescible wastes; several fires; and odor problems.^(ref. 1) An unknown quantity of industrial chemicals were disposed in this pit for at least 5 years, ending in 1974.^(ref. 1) In addition, wood,

FIGURE 1
MOBILE WASTE CONTROLS
SITE LOCATION MAP



EXPLANATION

- — — APPROXIMATE BOUNDARY OF CLOSED
LANDFILL BASED ON AIR PHOTO (DEC. 1973).
- ⊕ MONITOR WELL
- x — x — x — FENCE LINE

0 500
APPROXIMATE SCALE IN FEET

paper, plastics, rubber, metal, neoprene, Styrofoam, urethane, PVC pellets, plastic resins, asbestos, oil-contaminated filter cake, asphalt, and municipal garbage have been disposed at the site.^(ref. 1) The total volume and precise composition of the waste disposed at the site is not known.

The in place thickness of the disposed materials varies from 1 to 16 feet, with the deepest portion of the excavation near the southwest corner.^(ref. 1) The thickness of the final cover varies from less than 6 inches over large, central portions of the area to over 6 feet in areas along the north side of the closed landfill.^(ref. 1) During the construction of the Windmill Lakes Subdivision, Windmill Lakes Boulevard was constructed over the landfill site (Figure 2, Area A).^(ref. 1) The landfill cap was disturbed by surveying and construction, resulting in exposed waste material which was subsequently covered.^(ref. 1)

The only known source is the disposed waste. Potential means of migration include the leachate produced within the closed landfill (disposal pit), light hydrocarbon gases (methane) produced by organic waste decomposition, and volatile constituents migrating through the vadose soil zone and into the atmosphere.^(ref. 1) Numerous investigations have shown that in nonarid regions, infiltration of water through refuse causes water table mounding within or below the landfill.^(ref. 6) Water table mounding causes leachate to flow downward and outward from the landfill. Downward flow of leachate may threaten groundwater resources. Outward flow normally causes leachate springs at the periphery of the landfill or into surface water bodies.^(ref. 6)

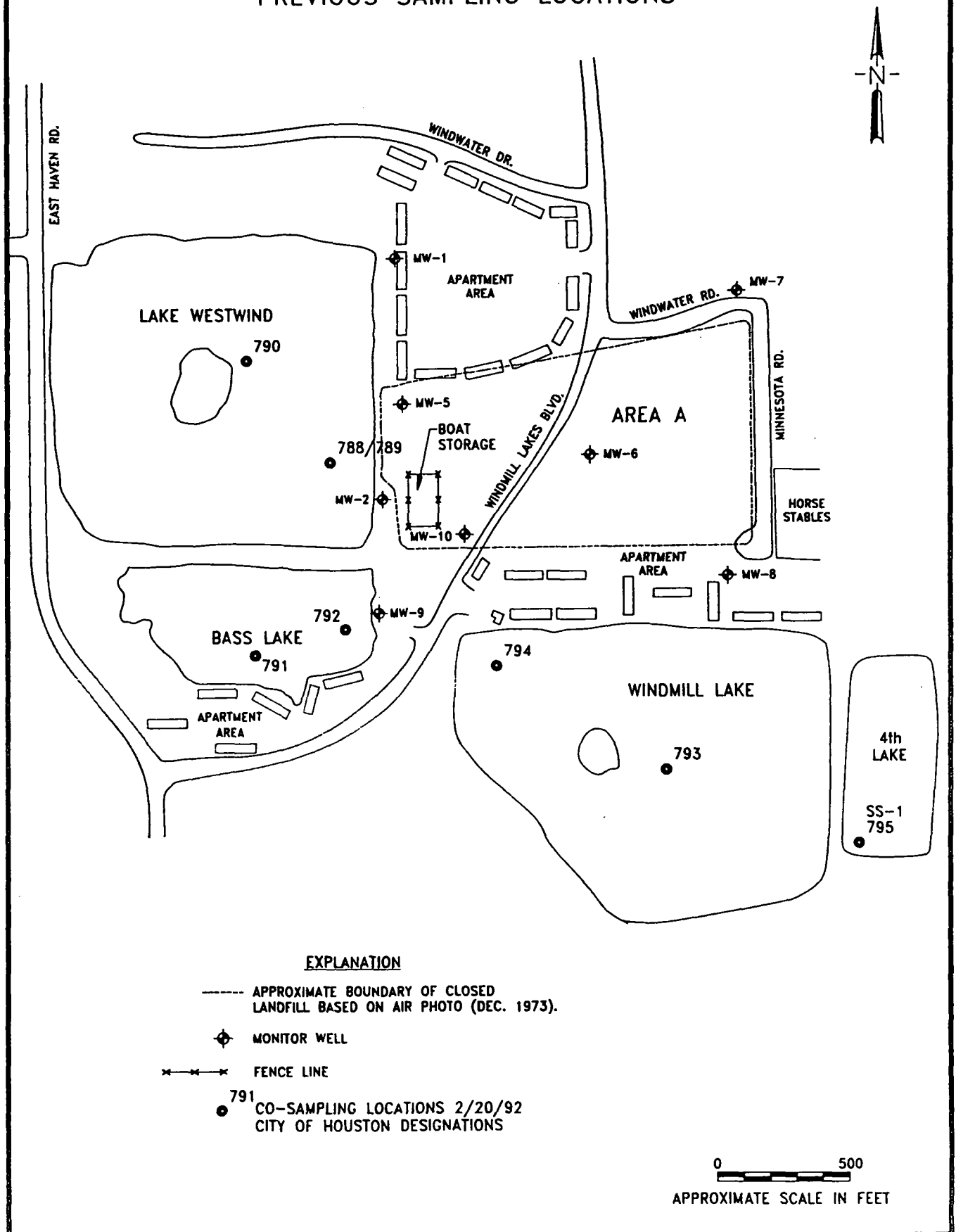
Resource Engineering, Inc. (REI), (hired by Levering & Reid), and the City of Houston Public Health Department conducted joint groundwater sampling at the site during 1982 and 1983.^(ref. 1) Groundwater sample results indicated elevated concentrations of total suspended solids (TSS), and total organic carbon (TOC), high chemical oxygen demand (COD), and the presence of benzene, toluene, and several complex organic compounds in the monitoring wells sampled.^(ref. 1) Concentrations of contaminants and indicator parameters reported during the well sampling program are summarized as follows:

- TSS ranged from 420-17,770 mg/L.
- COD ranged from 0-2,400 mg/L.
- TOC ranged from 64-313 mg/L.

The concentration ranges for identified contaminants of concern found in analyses of the landfill leachate (well 6) and surrounding groundwater (wells 1, 2, and 5) were:

- Benzene (0.01-0.24 µg/L)
- Toluene (0.05-96.00 µg/L)
- Ethylbenzene (0.08-175.41 µg/L)
- 2-Nitropropane (0.19 µg/L)
- Chlorobenzene (3.53 µg/L)

FIGURE 2
MOBILE WASTE CONTROLS
PREVIOUS SAMPLING LOCATIONS



- Cyclohexane (2.12-287.16 µg/L)
- Xylene (9.30-1,853.40 µg/L)
- Aniline (4,285.2 µg/L)
- Naphthalene (0.10-24.10 µg/L)
- 1,4-Dichlorobenzene (7.10 µg/L)
- 1,1'-Diphenylhydrazine (943.9 µg/L)
- N-nitrosodiphenyl amine (1.00-126.6 µg/L)
- 2-Methyl phenol (191.00 µg/L)
- 2,4-Dimethyl phenol (9.20 µg/L)
- 2,3-Dimethyl phenol (2.70 µg/L)
- Diethyl phthalate (1.20-14.20 µg/L)
- Styrene (831.8 µg/L).

In 1983 detectable levels of extractable priority pollutants were present in the leachate samples collected from the landfill; however, the leachate was not determined to be hazardous according to Resource Conservation and Recovery Act (RCRA) standards.^(ref. 1) Ten aliphatic hydrocarbons (oil constituents and/or stable organic decomposition products); 14 fatty acids; and 11 RCRA-listed organic compounds (toluene, xylene, aniline, naphthalene, 1,4-dichlorobenzene, 1,1'-diphenylhydrazine, N-nitrosodiphenyl amine, 2-methyl phenol, 2,4-dimethyl phenol, 2,3-dimethyl phenol, and diethyl phthalate) were also detected in the leachate.^(ref. 1)

Six leachate samples were obtained from monitoring well 6, near the center of the landfill, from September through December 1982.^(ref. 1, Atch. 7, p. 27) The maximum concentrations representing measured leachate characteristics were:

TDS	14,177 mg/L
Sulfate (SO ₄)	790 mg/L
Manganese (Mn)	8.80 mg/L
Iron (Fe)	313 mg/L
Sodium (Na)	2,772 mg/L
Chloride (Cl)	4,140 mg/L
TOC	3,976 mg/L

The City of Houston, the TWC District 7 office, and the FDIC, through Ameresco Management, participated in a joint groundwater, surface water, and lake sediment sampling program during December 1991 and February 1992.^(ref. 2) Existing monitoring wells were sampled on December 11, 1991. Sediment, soil, and lake samples were collected on February 20, 1992. The sample locations are indicated on Figure 2.^(ref. 3) The results of the analytical program are summarized in Tables 1 through 9. The parameters listed include metal and water quality data, and detected organic compounds.

Table 1 Mobile Waste Controls Results of TWC Monitoring Well Sampling Program
December 11, 1991

Well ID	COD (mg/L)	TOC (mg/L)	Cl ⁻ (mg/L)	TSS (mg/L)	VSS (mg/L)	TDS (mg/L)	Cyanides (mg/L)	Phenols (mg/L)	NO ₂ -N (mg/L)	NO ₃ -N (mg/L)
MW-1	<5	5	132	244	14	814	-	-	-	-
MW-2	Sample data not taken at this time.									
MW-5	350	129	782	134	25	2,160	<0.02	23	<0.01	<0.01
MW-6	134	6	58	<5	26	831	<0.02	<5	<0.01	<0.01
MW-8	60	25	NA*	23	5	1,270				
MW-9	157	57	553	75	15	1,760	<0.02	15	<0.01	<0.01
MW-10	531	192	73	194	62	2,400	<0.02	40	<0.01	<0.01

* Copy of analytical data sheet indecipherable.

NA Not available.

Table 2
Mobile Waste Controls
Monitoring Well Sampling Results
December 11, 1991

December 11, 1991	Ag	As	Ba	Cd	Cr	Cu	Hg	Mn	Ni	Pb	Se	Zn	Al	Co	V	Chloride	COD	Cyanide	pH	Phenol	Sulfide	TDS	TOC	VSS	TSS
	ug/L															mg/L		ug/L		ug/L	mg/L				
MW-1	<0.2	<4.0	290	3.6	<5.0	8.8	0.98	77.0	<22.0	5.20	<4.0	44.0	880	<9.0	<8.0	118	60	<10	6.84	<10	<0.16	770	2.2	93	253
MW-2	<0.2	2100	500	1.0	<5.0	<8.0	<0.2	4000	30.0	<0.2	<4.0	14.0	190	<9.0	<8.0	470	180	<10	6.80	211	1.12	1800	49	40	120
MW-5	<0.2	66	1100	0.9	<5.0	<8.0	<0.2	2800	<22.0	<0.2	<4.0	38.0	310	<9.0	11.0	667	320	<10	6.82	310	1.44	2380	105	60	160
MW-6	<0.2	83	840	13.0	26.0	<8.0	<0.2	2400	<22.0	230	<4.0	180,000	690	16.0	57.0	51	80	<10	6.93	21	0.48	790	19	400	1700
MW-7	Not Sampled at this Time																								
MW-8	<0.2	9.7	610	3.0	<5.0	<8.0	<0.2	1500	<22.0	2.8	<4.0	41.0	220	<9.0	<8.0	220	70	<10	6.84	<10	<0.16	1270	19	<10	30
MW-9	<0.2	5.2	240	1.6	<5.0	<8.0	<0.2	570	<22.0	5.5	<4.0	31.0	2600	<9.0	9.4	90	40	<10	7.44	<10	<0.16	500	1.8	<10	260
MW-9D	<0.2	4.4	220	0.9	<5.0	<8.0	<0.2	540	<22.0	2.6	<4.0	23.0	2600	<9.0	9.6	86	40	<10	7.47	<10	<0.16	530	1.3	100	900
MW-10	<0.2	16.0	560	3.8	10.0	51.0	4.0	990	<22.0	7.2	<4.0	110.0	1200	<9.0	10.0	852	560	<10	6.67	404	4.96	2310	211	60	160

Table 3
Mobile Waste Controls
Concentrations of Volatile, Semi-Volatile and Organic Compounds in Water
December 11, 1991

	Volatiles								Semi-Volatiles					
December 11, 1991	acetone	1,1,2,2-tetrachloroethane	chloroform	benzene	toluene	chlorobenzene	ethylbenzene	xylenes (total)	naphthalene	4-chloroaniline	Bis (2-ethylhexyl) phthalate	benzoic acid	2-methylnaphthalene	N-Nitrosodiphenylamine
	ug/L								ug/L					
MW-1	14	3*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-2	11	ND	ND	7	ND	19	ND	ND	2*	140	6*	ND	ND	ND
MW-5	29	ND	6	11	9	16	32	16	17	83	4*	ND	ND	ND
MW-5D	NA	NA	NA	12	9	16	34	16	ND	ND	ND	ND	ND	ND
MW-6	20	ND	ND	ND	ND	6	ND	ND	ND	ND	10*	19*	ND	ND
MW-7	Not Sampled at this Time													
MW-8	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3*	ND	ND	ND
MW-9D	6*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-10	11	ND	ND	14	ND	26	95	26	13*	550**	13*	ND	9*	22

NA - Not Available

ND - Not Detected

* - Below listed detection limit

** - Compound amount taken from a 1:10 dilution

	Organics				
December 11, 1991	2,4,5TP (SINex)	Dalapon	Dicamba	Dichloroprop	Dinoseb
	ug/L				
MW-10	0.16*	16	1.4	3.3	1.4

* - Below method detection limit

Table 4 Mobile Waste Controls Results of TWC Sampling Program
February 20, 1992

Sample ID	City of Houston Sample ID	Location	COD (mg/L)	Results TOC (mg/L)	Cl ⁻ (mg/L)
Westwind Lake					
WEST #1	790	Mid-lake; east side of island	<5	7	21
WEST #2	788/789	East bank near MW-2	<5	5	21
Bass Lake					
BASS #1	792	East corner along bank near MW-9	<5	3	19
BASS #2	791	Mid lake; north side island	<5	3	19
Windmill Lake					
WIND #1	794	North of pier	<5	5	13
WIND #2	793	North side of island; mid-lake	<5	4	13
4th Lake	795	South bank of 4th lake	16	7	14

Table 5 Mobile Waste Controls Results of City of Houston Lake and
Sediment Sampling February 20, 1992

Sample ID	Sample Matrix	Volatile Priority Pollutants Detection Limit 10 ppb	Semi-volatile Priority Pollutants Detection Limit 10 ppb	Fecal Coliform
788	Water	ND	ND	<200
789	Water	ND	ND*	400
790	Water	ND	ND	<200
791	Water	ND	ND	NA
792	Water	ND	ND	NA
793	Water	ND	ND	NA
794	Water	ND	ND	NA
795	Water	ND	ND	NA

ND Not detected.

NA Not available.

* Detection limit 20 ppb.

Table 6 Mobile Waste Controls
Results of City of Houston Lake Sampling
February 20, 1992

Sample ID	Ag (mg/L)	As (mg/L)	Ba (mg/L)	Cd (mg/L)	Cr (mg/L)	Cu (mg/L)	Hg (mg/L)	Mn (mg/L)	Ni (mg/L)	Pb (mg/L)	Zn (mg/L)	Se (mg/L)
788	<0.01	<0.001	<0.1	<0.01	<0.01	<0.01	<0.001	<0.01	<0.03	<0.04	<0.01	<0.002
790	<0.01	<0.001	<0.1	<0.01	<0.01	<0.01	<0.001	<0.01	<0.03	<0.04	<0.01	<0.002
791	<0.01	0.003	<0.1	<0.01	<0.01	0.05	<0.001	<0.01	<0.03	<0.04	<0.01	<0.002
792	<0.01	<0.001	<0.1	<0.01	<0.01	<0.01	<0.001	<0.01	<0.03	<0.04	<0.01	<0.002
793	<0.01	<0.001	0.27	<0.01	<0.01	<0.01	<0.001	<0.01	<0.03	<0.04	<0.01	<0.002
794	<0.01	<0.001	0.54	<0.01	<0.01	<0.01	<0.001	<0.01	<0.03	<0.04	<0.01	<0.002
795	<0.01	<0.001	<0.1	<0.01	<0.01	<0.01	<0.001	<0.01	<0.03	<0.04	<0.01	<0.002

Table 7
Mobile Waste Controls
Concentrations of Metals in Water Matrix
February 20, 1992

February 20, 1992	Ag	Al	As	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	Hg	K	Mg	Mn	Na	Ni	Pb	Sb	Se	Ti	V	Zn	Fecal Coliform
	ug/L																							Colonies/100 ml
Bass-2	<2.0	270	<2.0	82	<1.0	13,719	<3.0	<4.0	<3.0	5.3	149	<0.2	2,128	2,781	5.7	48,385	<22.0	<1.0	<30.0	<2.0	3.2	44.0	10.0	401
Wind-1	<2.0	84.0	<2.0	87.0	<1.0	18,148	<3.0	<4.0	<3.0	<3.0	99.0	<0.2	2,314	4,295	6.6	22,850	<22.0	<1.0	<30.0	<2.0	<2.0	<4.0	16.0	<1
West-1	<2.0	82.0	<2.0	85.0	<1.0	18,090	<3.0	<4.0	<3.0	3.3	95.0	<0.2	2,903	6,526	6.2	23,890	<22.0	<1.0	<30.0	<2.0	<2.0	<4.0	13.0	<1
West-2	<2.0	112	3.0	91.0	<1.0	29,893	<3.0	<4.0	<3.0	3.9	116	<0.2	3,037	8,822	7.0	25,071	<22.0	<1.0	<30.0	<2.0	<2.0	<4.0	17.0	27
Bass-1	<2.0	302	3.0	85.0	<1.0	13,824	<3.0	<4.0	<3.0	6.3	168	<0.2	1,611	2,889	5.3	51,669	<22.0	<1.0	<30.0	<2.0	<2.0	<4.0	19.0	<1
Wind-2	<2.0	85.0	5.4	71.0	<1.0	18,386	<3.0	<4.0	<3.0	<3.0	82.0	<0.2	1,818	4,276	4.4	22,687	<22.0	<1.0	<30.0	<2.0	<2.0	<4.0	19.0	<1
4th Lake	<2.0	178	5.0	108	<1.0	33,687	<3.0	<4.0	<3.0	5.8	531	<0.2	2,531	8,002	224	26,985	<22.0	5.7	<30.0	3.0	<2.0	44.0	47.0	<1

- 14 -

Concentrations of Metals in Sediment and Soil Matrix

February 20, 1992	Ag	Al	As	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	Hg	K	Mg	Mn	Na	Ni	Pb	Sb	Se	Ti	V	Zn	Matrix
	mg/Kg																							
Bass-2	<1.9	19,576	13.0	149	<0.93	3,902	<280	7.1	17.0	58.0	15,447	<0.47	1,642	2,483	90.0	591	<20.0	26.0	<28.0	<1.9	7.2	32.0	59.0	Sediment
Wind-1	<0.62	1,589	3.3	18.0	<0.31	632	0.93	1.9	2.3	4.3	2,034	<0.16	173	257	12.0	48.0	<6.6	4.3	<4.5	<0.62	0.62	5.6	13.0	Sediment
West-1	<0.78	6,573	9.7	72.0	<0.39	9,753	<1.2	4.3	9.3	19.0	9,216	<0.19	1,265	1,852	237	139	8.9	16.0	<12.0	<0.77	<0.77	18.0	53.0	Sediment
West-2	<1.3	28,829	17.0	128	<0.67	21,131	<2.0	10.0	26.0	37.0	19,749	<0.34	4,151	5,713	272	270	24.0	32.0	<20.0	<1.3	<1.3	41.0	122	Sediment
Bass-1	<0.62	5,917	5.1	43.0	<0.31	101	<0.92	4.6	5.5	4.0	5,678	<0.15	541	819	56.0	147	<6.6	6.3	<9.2	<0.62	<0.62	14.0	12.0	Sediment
Wind-2	<1.2	11,159	6.6	128	0.94	3,173	<1.6	7.1	12.0	9.7	11,050	<0.3	1,235	1,972	128	195	144	20.0	<18.0	<0.59	<1.2	24.0	41.0	Sediment
4th Lake	<0.58	14,551	5.9	103	<0.29	1,812	<0.87	4.9	14.0	7.0	14,858	<0.15	1,180	1,859	32.0	299	11.0	9.3	<6.7	<0.58	<0.58	28.0	18.0	Sediment
SS-1	<0.55	12,561	6.2	407	<0.27	30,636	0.83	15.0	16.0	16.0	24,857	<0.14	2,235	4,280	327	468	16.0	15.0	<6.3	<0.55	<0.55	56.0	36.0	Soil

Table 8
Mobile Waste Controls
Concentrations of Volatile Organic Compounds in Water, Sediment and Soil Matrices
February 20, 1992

MATRIX	WATER	SEDIMENT AND SOIL								
February 20, 1992	acetone	methylene chloride	acetone	2-butanone	bis (2-ethylhexyl) phthalate	1,1-Dichloroethene	trichloroethene	benzene	toluene	chlorobenzene
	ug/L	mg/Kg			ug/Kg					
Bass-2 (1)	8*	45	160	35*	ND	ND	ND	ND	ND	ND
Bass-2 (2)	ND	59	250	50	190	ND	ND	ND	ND	ND
Wind-1 (1)	6	18	33	ND	ND	ND	ND	ND	ND	ND
Wind-1 (2)	ND	28	61	ND	ND	ND	ND	ND	ND	ND
West-1	6*	ND	ND	ND	ND	ND	ND	ND	ND	ND
West-2 (1)	4*	17*	99	ND	ND	ND	ND	ND	ND	ND
West-2 (2)	ND	47	220	34	ND	ND	ND	ND	ND	ND
Bass-1 (1)	5*	NA	21	ND	ND	ND	ND	ND	ND	ND
Bass-1 (2)	ND	ND	80	ND	ND	ND	ND	ND	ND	ND
Wind-2	4*	ND	ND	ND	ND	ND	ND	ND	ND	ND
4th Lake (1)	9*	9	ND	ND	ND	ND	ND	ND	ND	ND
4th Lake (2)	ND	19	ND	ND	ND	ND	ND	ND	ND	ND
4th Lake-MS (1)	ND	27	ND	ND	ND	98	83	90	82	91

MATRIX	WATER								
February 20, 1992	acetone	methylene chloride	2-butanone	bis (2-ethylhexyl) phthalate	1,1-Dichloroethene	trichloroethene	benzene	toluene	chlorobenzene
	ug/L								
4th Lake-MS (2)	4*	ND	ND	ND	53	44	53	47	46

ND - Not Detected

* - Below listed detection limit

(1) Initial sampling analytical results

(2) re-analysis of same sample; dilution factors may change.

MS - Matrix spike

Table 9
Mobile Waste Controls
Concentrations of Semi-Volatile Organic Compounds in Water Matrix
February 20, 1992

MATRIX	WATER											
February 20, 1992	Isophorone	phenol	2-chlorophenol	1,4-dichlorobenzene	N-Nitrosodipropylamine	1,2,4-trichlorobenzene	P-Chloro-M-Cresol	Acenaphthene	4-nitrophenol	2,4-dinitrotoluene	pentachlorophenol	Pyrene
	ug/L											
4th Lake (MS)	ND	98	120	73	64	73	130	71	180	81	120	110
4th Lake (MSD)	ND	94	150	140	110	170	230	160	180	210	180	210

- 16 -

Mobile Waste Controls
Concentrations of Semi-Volatile Organic Compounds in Sediment and Soil Matrix

MATRIX	SEDIMENT AND SOIL											
February 20, 1992	Isophorone	phenol	2-chlorophenol	1,4-dichlorobenzene	N-Nitrosodipropylamine	1,2,4-trichlorobenzene	P-Chloro-M-Cresol	Acenaphthene	4-nitrophenol	2,4-dinitrotoluene	pentachlorophenol	Pyrene
	ug/Kg											
West-1	100*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4th Lake (MS)	ND	1,700	2,100	1,100	400*	1,200	2,200	1,200	1,900*	1,500	ND	1,500
4th Lake (MSD)	ND	1,800	2,200	1,200	440	1,300	2,500	1,300	2,400	1,800	250*	1,900

ND - Not Detected

* - Below listed detection limit

** - Re-analysis of semi-volatile compounds not summarized on this table

MS - Matrix spike

MSD - Matrix spike duplicate

Acetone was detected during the QA/QC analysis for the December 11, 1991, sampling program. This indicates that the presence of acetone in the sample could have resulted from acetone contamination of laboratory instruments and/or the laboratory sample containers.^(ref. 5) Sample data will be required to confirm that the presence of acetone is a laboratory artifact.

As previously mentioned, a potential problem is light hydrocarbon (methane) gas emissions generated from organic wastes deposited in the landfill. The thin cover over large portions of the fill, coupled with poor compaction of the waste materials within, will tend to promote gas migration through the surface of the landfill and into the atmosphere.^(ref. 1, Atch. 7, p. 18-19) Since methane is flammable at concentrations of 5 to 15 percent (volume) in air, escape of gas from the landfill could present a potential fire risk.^(ref. 1)

Based on this characterization of the site, the primary contaminants of concern are benzene, toluene, ethylbenzene, 2-nitropropane, chlorobenzene, cyclohexane, xylene, aniline, naphthalene, 1,4-dichlorobenzene, 1,1'-diphenylhydrazine, N-nitrosodiphenyl amine, 2-methyl phenol, 2,4-dimethyl phenol, 2,3 dimethyl phenol, diethyl phthalate, styrene, and metals.^(ref. 1) In addition, wood, paper, plastics, rubber, metal, neoprene, styrofoam, urethane, PVC pellets, plastic resin, asbestos, oil-contaminated filter cake, asphalt, and municipal garbage were disposed at the site and can be considered contaminants of concern. ^(ref. 1) Additionally, accumulation of methane in adjacent structures presents a health and safety concern.

Required Information (Data Gaps)

- Verification of site features as depicted on the site location map. In particular, the location of the monitoring wells will be verified.
- Verification of sampling performed at the site, including the location of the lake and sediment samples obtained during the sampling program performed by the TWC, the City of Houston, and the FDIC.
- Verification of existing analytical data results required through additional testing and additional review of laboratory QA/QC data.
- Field verification of landfill cover thickness required to determine containment of the potential source for the soil exposure pathway or release to the air pathway.

GROUNDWATER PATHWAY AND TARGETS

Characteristics

The Houston area is situated on the Quaternary Coastal Plain of Texas.^(ref. 7) Specifically, the site is underlain by the Pleistocene Age, Beaumont Formation.^(ref. 8) The Beaumont Formation beneath the site is described as barrier island and beach deposits consisting of mostly clay, silt, and sand. The mapped geologic unit includes mainly stream or river channel, point bar, natural levee, and backswamp deposits and, to a lesser extent, coastal marsh and mud flat deposits with concentrations of calcium carbonate, iron-oxide, and iron manganese oxide nodules in zones of weathering.^(ref. 7) The soils beneath the site have been mapped as relict fluvial and

deltaic deposits, sand units, locally clayey, that are easily excavated, with low to moderate erosion potential, low shrink-swell potential, high bearing strength, moderate permeability, and low to moderate moisture retention at the surface.^(ref. 8)

The site is underlain by the Chicot Aquifer, which is the youngest aquifer of the Coastal Plain of Texas as indicated by the stratigraphic cross-section C-C'.^(ref. 9) The Chicot Aquifer includes the following formations: the Willis Sand, the Bentley Formation, the Montgomery Formation, the Beaumont Clay, and any overlying Holocene alluvium. In the vicinity of the site, the Chicot Aquifer reaches an average thickness of approximately 600 feet.^(ref. 9) Wells in the vicinity of the site are screened in saturated intervals ranging from 98 to 1,000 feet below surface. Water levels in these wells range from depths of 8.5 to 260 feet below ground surface.^(ref. 1)

The local stratigraphy and depth to groundwater were determined during the site evaluation activities performed at the site by REI during 1982 and 1983.^(ref. 1, Atch. 7) Six soil borings were logged and completed as monitoring wells during this investigation. The general subsurface stratigraphy beneath the site is alternating layers of clay and sand.^(ref. 1) Generally, the uppermost interval, ranging from 7 to 9 feet in thickness, is described as a sandy clay. Beneath this interval is a clayey sand to silty sand unit ranging from 4 to 20 feet in thickness. The stiff, reddish-brown clay interval beneath the sand interval ranges from 10 to 12 feet thick, and the sand unit beneath the reddish-brown clay interval ranges from 2 to 10 feet thick.^(ref. 1, Atch. 7) All monitoring wells constructed at the site by REI were screened across this uppermost saturated interval approximately 8 to 25 feet below ground surface.^(ref. 1) Table 10 summarizes monitoring wells construction details.^(ref. 1)

The monitoring well water levels in the sandy stratigraphic interval screened in wells 2, 3, and 5 correlated with the water levels recorded from Lake Westwind.^(ref. 1) In addition, a shallow groundwater mounding effect was reported beneath the covered landfill area, potentially contributing to contaminant migration from the landfill to the west and southwest.^(ref. 1) The depth of the landfill excavation averages 13 feet and attains a maximum depth of 16 feet in the southwest corner of the excavation, based on the resistivity survey completed by REI.^(ref. 1) Shallow groundwater, occurring from 8-15 feet below surface in the area of the pit excavation (based on monitoring well depths), would therefore come in contact and potentially be contaminated by the buried waste materials.^(ref. 1)

The municipal or domestic wells located nearest to the site are screened at intervals of 85 to 105 feet below ground surface.^(ref. 1) These wells were installed for domestic or irrigation water use.^(ref. 1) The average groundwater yield data for the water wells near the site in the saturated interval from 85 to 105 feet below surface is approximately 30 gpm (Table 11). The general groundwater flow direction in the vicinity of the site mimics geologic dip and is toward the southeast.^(ref. 9) The saturated intervals encountered while drilling in the vicinity of the site are all considered part of the Chicot Aquifer.^(ref. 9) Based on available driller's logs, wells are screened at three primary depths in the Chicot Aquifer, 8-25 feet (monitoring wells), 88-103 feet, and 440-470 feet below surface. Groundwater quality data for the shallow saturated interval in the vicinity of the site are reported above. Static water levels recorded on water well drilling records for the domestic wells located on East

Table 10 Mobile Waste Controls
Summary of Well Construction Details for Monitoring Wells(ref. 1, Atch. 7)

Well ID	Boring Depth	Well Material	Screened Interval	Screen Length	Well Diameter
MW-1	20'	PVC	5-15'	10'	4"
MW-2	25'	PVC	8-18'	10'	4"
MW-3	29'	PVC	6-24'	18'	4"
MW-4	23'	PVC	8-20'	12'	4"
MW-5	17'	PVC	12.5-17'	4.5'	4"
MW-6	16'	PVC	6-16'	10'	2"

* As-built well diagram (reference 1, attachment 7) indicates well diameter is 4 inches, although diagram scale used resembles 2-inch diameter well.

TABLE II
MOBILE WASTE CONTROLS
SUMMARY OF WATER WELLS WITHIN 1-MILE

WELL ID #/ LOCATION	WELL TD	SCREENED INTERVAL	TOTAL SAND/GRAVEL THICKNESS **	TOTAL CLAY THICKNESS	STATIC WATER LEVEL	CHEMICAL ANALYSIS	FLOW RATE	WELL USE
65-31-1C / 10121 WINDMILL LAKES BLVD. HOUSTON, TX	470'	440-470	208	262	200	NO	N / A	IRRIGATION
65-22-6 / 10121 WINDMILL LAKES BLVD. HOUSTON, TX	470'	440-470	208	262	200	NO	N / A	IRRIGATION
65-31-1E / 10039 RADIO ROAD HOUSTON, TX	450'	440-450	126	321	160	NO	JETTED / 25 gpm	DOMESTIC
65-31-1E / 10035 RADIO ROAD HOUSTON, TX	103'	93-103	61	40	10	NO	JETTED / 30 gpm	DOMESTIC
65-31-1B / 9913 EASTHAVEN HOUSTON, TX	94'	88-94	81	11	27	NO	DEEP WELL JET / 500 gph	DOMESTIC
65-31-1C / 9421 LAMBRIGHT HOUSTON, TX	94'	88-94	74	19	27	NO	DEEP WELL JET / 900 gph	DOMESTIC
65-31-1L / 11400 GULF FREEWAY HOUSTON, TX 77034	90'	88-90	26	64	12	NO	N / A	DOMESTIC

** DOES NOT INCLUDE FILL OR TOP SOIL.

TABLE II
MOBILE WASTE CONTROLS
SUMMARY OF WATER WELLS WITHIN 1-MILE

WELL ID #/ LOCATION	WELL TD	SCREENED INTERVAL	TOTAL SAND/GRAVEL THICKNESS **	TOTAL CLAY THICKNESS	STATIC WATER LEVEL	CHEMICAL ANALYSIS	FLOW RATE	WELL USE
65-31-4C / 9905 RADIO ROAD HOUSTON, TX 77075	345'	325-345	105	237	190	NO	JETTED / 25 gpm	DOMESTIC
65-30-3F / 10305 MOERS HOUSTON, TX 77075	231'	90-100	61	166	12	NO	JETTED / 35 gpm	DOMESTIC
65-30-3E / LAMBRIGHT HOUSTON, TX	98'	90-98	58	37	6	NO	BLOW W/COMPRESSOR BY DRILLS / 125 gpm	DOMESTIC
65-30-3E 9917 RADIO ROAD HOUSTON, TX 77304	348'	347 1/2-348	121	224	190	NO	JETTED / 75 gpm	DOMESTIC
65-30-3E / 9718 MOERS ROAD HOUSTON, TX 77034	87'	80-87	52	35	18	NO	N / A	DOMESTIC
65-30-3F / LAMBERT HOUSTON, TX	348'	338-348	86	259	183	NO	JETTED / 60 gpm	INDUSTRIAL
65-30-3F / MYKOWIA ROAD HOUSTON, TX	94'	86-94	37	55	18	NO	AIR COMPRESSOR / 35 gpm	DOMESTIC
65-23-7F / 9731 RADIO ROAD HOUSTON, TX 77034	352'	325-340	113	235	170	NO	SUBMERSIBLE / 13 gpm	DOMESTIC

** DOES NOT INCLUDE FILL OR TOP SOIL.

TABLE 11
MOBILE WASTE CONTROLS
SUMMARY OF WATER WELLS WITHIN 1-MILE

WELL ID #/ LOCATION	WELL TD	SCREENED INTERVAL	TOTAL SAND/GRAVEL THICKNESS **	TOTAL CLAY THICKNESS	STATIC WATER LEVEL	CHEMICAL ANALYSIS	FLOW RATE	WELL USE
65-23-7G / 11412 GULF FREEWAY HOUSTON, TX	350'	330-350	50	295	185	NO	N / A	DOMESTIC
65-22-9R / 9924 RADIO ROAD HOUSTON, TX 77075	105'	95-105	73	29	29	NO	JETTED / 15 gpm	DOMESTIC
65-30-3 / 9205 WAYFARRER HOUSTON, TX	454'	444-454	81	370	215	NO	JETTED / 75 gpm	DOMESTIC
65-15-4 / 9825 RADIO ROAD HOUSTON, TX 77075	340'	330-340	62	275	175	NO	JETTED / 30 gpm	DOMESTIC

** DOES NOT INCLUDE FILL OR TOP SOIL.

Haven and Lambright roads were reported to be 27 feet below surface.^(ref. 1) These two wells were drilled and completed in what is apparently an equivalent thick sand deposit that was mined at the site. The excavated sand pits are now water filled and used for recreational purposes.^(ref. 1) The water well drilling records identify sand and clay depths and thicknesses encountered while drilling. Both wells averaged a sand percentage ranging from 75 to 85 percent. The potential for a hydraulic connection between the relatively thick sand deposits encountered at the two domestic wells at East Haven and Lambright roads and the sand units intercepted by the waste pit sidewalls will be investigated during the sampling program.

Results of subsurface soil testing conducted prior to the construction of the Windmill Lakes Subdivision and Windmill Lakes Boulevard indicate that the uppermost sandy clay (occurring at approximately 8 feet below ground surface) is a low plasticity clay with liquid limits of approximately 28 percent and a plasticity index (PI) of approximately 16 percent. The percentage of soil particles passing the No. 200 sieve was approximately 60 percent. The clayey to silty sand interval beneath the uppermost sandy clay consists of approximately 93 to 70 percent soil grains that do not pass through a No. 200 sieve. This interval was saturated during soil boring activities; depth to water ranged from 5.5 to 12.5 feet below surface. The clayey to silty sand interval exhibited a laboratory vertical permeability in the range of 1×10^{-5} cm/sec.^(ref. 1)

The clay interval beneath the clayey to silty sand unit occurs at approximately 25 feet below ground surface. This clay exhibited liquid limits which ranged from 60 to 85 percent, plasticity indices ranging from 39 to 57 percent, and 96 percent of the clay samples analyzed did not pass the No. 200 sieve. The clay samples tested exhibited a laboratory vertical permeability in the range of 1×10^{-9} to 7×10^{-8} cm/sec.^(ref. 1) No surface soil samples are known to have been collected for analytical testing.

Targets

Two hundred seventy-eight private, irrigation, industrial, municipal and monitoring wells are located within a four-mile radius of the site.^(ref. 1) Sixteen private and irrigation wells are located within a 1-mile radius of the site. In addition, eight monitoring wells were installed within the 1-mile radius of the site to monitor local groundwater quality. Static water level measurements for these wells, including monitoring wells, ranged from 6 to 215 feet below surface. The wells were completed within the Chicot Aquifer.^(ref. 1) A summary of the characteristics of the wells located within a 1-mile radius of the site is presented as Table 11.

There is no analytical evidence indicating that any drinking water well has been contaminated by hazardous substances from the site.^(ref. 11) In October 1991, a domestic well located at 9917 Radio Road was sampled by the TWC and analyzed for TOC and metals analyses. The TWC reported less than 5 ppm TOC and no metals in the sample collected.^(ref. 1) One wellhead protection area is within a 4-mile radius of the site, the City of Houston Sagemont #2 well located approximately 2 miles southeast.^(ref. 1)

For wells within a 4-mile radius of the site:

- Within 0 - 0.25 miles of the site there are 2 domestic wells, 2 irrigation wells, and 8 monitoring wells.
- Between 0.25 - 0.50 miles, there are 7 private wells.
- Between 0.5 - 1.0 miles, there are 7 private wells
- Between 1.0 - 2.0 miles, there are 4 municipal supply wells, 70 private wells, 8 industrial wells, and 3 monitoring wells.
- Between 2.0 - 3.0 miles, there are 4 municipal supply wells, 59 private wells, and 11 industrial wells.
- Between 3.0 - 4.0 miles, there are 6 municipal supply wells, 76 private wells, and 13 industrial wells.
- There are 14 municipal supply wells within the 4-mile radius of the site.^(ref. 1)

not all
The locations of the domestic wells located within 1 mile of the site are indicated on Figure 3.^(ref. 1) Details of well construction, well use, pumpage rates, thicknesses of the sand and clay intervals of the Chicot aquifer, and static water levels for wells located within 1 mile of the site are summarized in Table 11.^(ref. 1) The screened intervals of wells in the vicinity of the site, excluding monitoring wells, range from 80 to 470 feet below ground level. The logs of the wells in the vicinity of the site describe the formation as alternating layers of sand and clay of the Chicot formation. The well installed through the greatest thickness of sand is located at 9913 East Haven Road in Houston, Texas. This well is within 0.25 mile of the site. The static water level of this well was 27 feet below ground surface. A pump test was not conducted during well development.^(ref. 1) The number of people served by the 16 domestic wells within 1 mile of the site is approximately 38.4 using the population factor (2.4 residents per household) developed during the PA.^(ref. 1) The groundwater population target calculations for distance increments were performed for the area within 1 mile of the site and are shown in Table 12.^(ref. 1)

The sources of the City of Houston and Kirkmont M.U.D. municipal water supply in the vicinity of the site are Houston-Galveston Coastal Subsidence District (HGCSD) well numbers 1094 and 1717.^(ref. 1) The population served by this water supply is 9,843.^(ref. 1) This information is summarized in Table 12.

Required Information (Data Gaps)

- Field verification to determine the location of existing wells and confirm the absence of additional water wells within a 1-mile radius of the site.
- Sample data required for local domestic wells to determine if contaminants have migrated through groundwater to the residential neighborhoods west of the site.
- Field or telephone verification of the number of people served by the 16 domestic water wells located within a 1-mile radius of the site.
- Field determination of level measurements obtained from nearby groundwater monitoring wells to develop groundwater elevation maps, illustrate groundwater flow conditions, and to assess the relationships of the ground

LEGEND

- * UNDOCUMENTED HOUSE NUMBERS
LOCATION TO BE VERIFIED
- NA NOT AVAILABLE
- ⊕ MONITORING WELL LOCATION
- ⊕ DOMESTIC SUPPLY WELL LOCATION
- ▨ APPROXIMATE AREA OF
CLOSED LANDFILL

WELL DESIGNATIONS-ADDRESSES

- A - 10121 WINDMILL LAKES BLVD.
B - 9913 EAST HAVEN
C - 10035 RADIO RD.
D - 10039 RADIO RD.
E - 9421 LAMBRIGHT
F - 11,400 GULF FREEWAY
G - 9905 RADIO RD.
H - 10305 MOERS RD.
I - 9917 RADIO RD.
J - 9718 MOERS RD.
K - NA LAMBRIGHT RD.
L - NA MYKAWA
M - 9731 RADIO RD.
N - 11,412 GULF FREEWAY
O - 9924 RADIO RD.
P - 9205 WAYFARER
Q - 9625 RADIO RD.
R - 3MW 145/CLEARWOOD

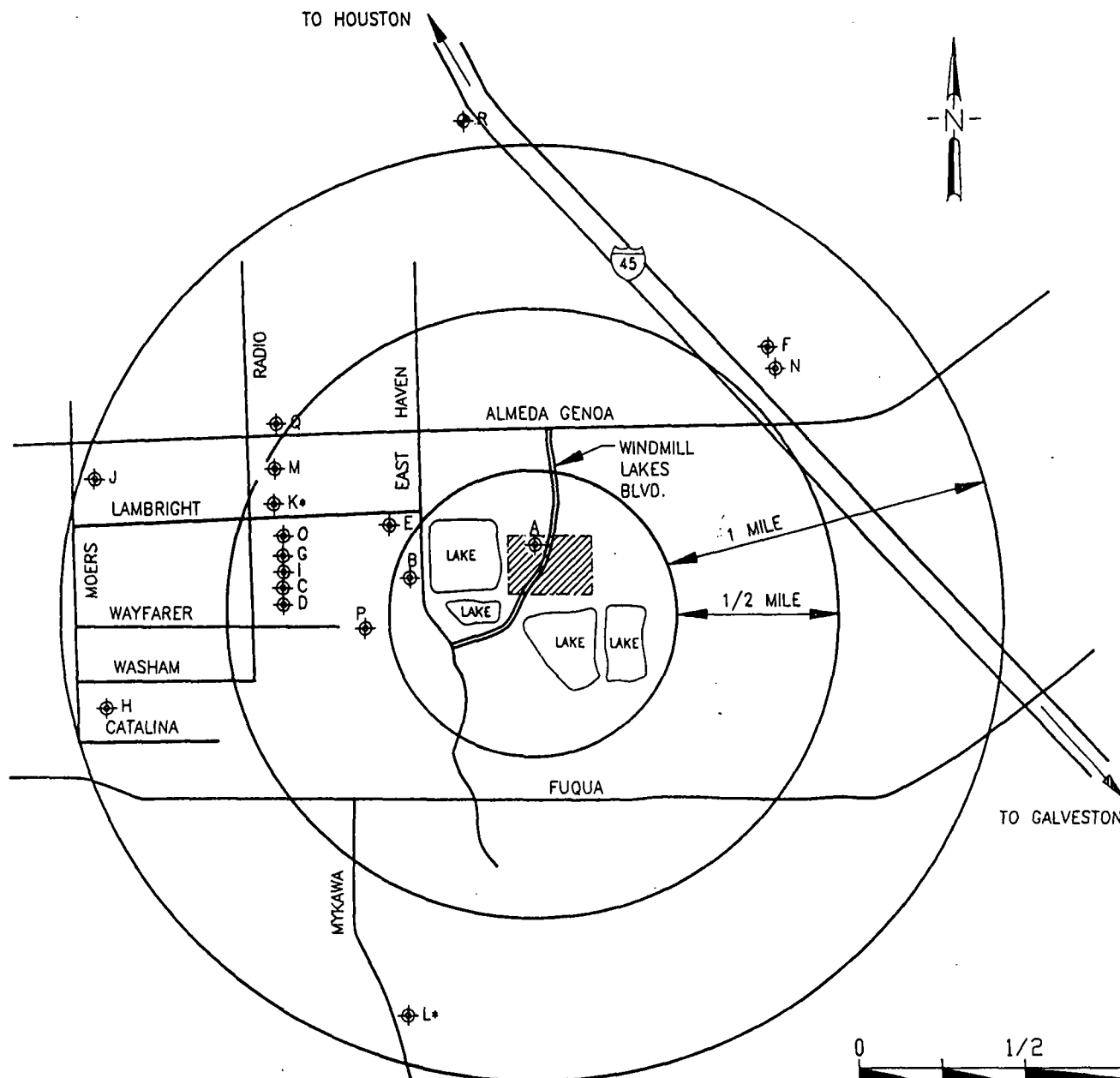


FIGURE 3

WELLS WITHIN 1 MILE
RADIUS OF SITE
MOBILE WASTE CONTROLS
TEXAS WATER COMMISSION

Table 12 Mobile Waste Controls Ground Water Population Target Calculations¹
August 28, 1992

Mile Radius	Type Well	No. Wells		Pop. Factor	Target Totals
0-0.25	Domestic	2	X	2.4	4.8
	Public Supply	0			0.0
	Industrial	0			0.0
	Irrigation	2	X	0	0.0
	Monitoring	6	X	0	0.0
Totals		10			4.8
0.25-0.50	Domestic	7	X	2.4	16.8
	Public Supply	0			0.0
	Industrial	0			0.0
	Irrigation	0			0.0
Totals		7			16.8
0.50-1.00	Domestic	7	X	2.4	16.8
	Public Supply	0			0.0
	Industrial	0			0.0
	Irrigation	0			0.0
Totals		7			16.8
1.00-2.00	Domestic	70	X	2.4	168.0
	Public Supply	4	X	2,735.0	10,940.0
	Industrial	8			0.0
	Irrigation	0			0.0
	Monitoring Wells	3			0.0
Totals		85			11,108.0

¹ EXPLANATION

- City of Houston (Jim Bell, [713] 223-1095), District 53, HGCSD Well No. 1040: 0.17 miles from site; well plugged in the 1970s. Target = 0. (ref. 1; Atch. 2)
- City of Houston (Jim Bell, [713] 223-1095), District 61 #1, HGCSD Well No. 1048: 0.93 miles from site; well plugged in 1991. Target = 0.
- Houston Lighting and Power Company, 4500 Shaver (Gene Fisseler, [713] 228-9211), South Houston Substation, HGCSD Well No. 1202: 0.76 miles from site; restroom facilities used by HL&P crews 7 days per week (estimated 42,000 gallons annual production). A minimum of one 3-person truck crew uses the station each day. Three people x 365 days = Target = 1,095.
- American Savings, State Well No. 65-31-1k: could not locate facility; Target = unknown.
- King of Kings Lutheran Church (Judy Griffin), State Well No. 65-23-7: two full-time employees with an average of 100 church members in attendance each Sunday. Target = 2.
- City of Houston (Jim Bell, [713] 223-1095), Sun Valley, HGCSD Well No. 1134: 1.23 miles from site; well plugged prior to 1980. Target = 0.
- City of Houston (Jim Bell, [713] 223-1095), Gulf Palms, HGCSD Well No. 1059: 1.87 miles from site; well plugged prior to 1980. Target = 0.

Table 12, continued

- City of Houston (Jim Bell, [713] 223-1095), Sagemont #2, HGCSD Well No. 1094: 1.88 miles from site; well is used as a standby well to provide water to the Sagemont area (approx. 5 square miles) should the surface water distribution line fail. This well can produce 850 gpm. Five (5) square miles x 1,584.62 residents per square mile for Harris County = Target = 7,923.
- Kirkmont M.U.D. (P. John Kuhl, [713] 850-9000), HGCSD Well No. 1717: 1.96 miles from site; public supply well with approximately 800 connections; Ray Cherry is district operator. 800 x 2.4 residents per Harris County household = Target = 1,920.

water to the elevation of the disposal pit. Survey data is also required to determine elevations of monitoring well measuring points and calculate groundwater elevation.

- Sample data to determine if subsurface contamination is present in soil and groundwater beneath the landfill.

SURFACE WATER PATHWAY AND TARGETS

Characteristics

The site is located in the San Jacinto-Brazos Coastal Basin, Segment 1102.^(ref. 1) This segment, Clear Creek Above Tidal, is classified as water quality limited and is 44 miles in length and drains an undetermined area.^(ref. 12) Thirty-one permitted outfalls discharge a total of 30.44 millions of gallons per day (MGD) to Segment 1102, including 23 domestic (30.35 MGD) and 8 industrial (0.09 MGD) outfalls. There are two TWC ambient surface water quality monitoring stations, 1102.0100 and 1102.0200, for this segment, located 5.8 and 7.3 miles from the site. Surface water quality data for Segment 1102 are presented in Table 13.^(ref. 12)

Areal drainage in the vicinity of the site is generally to the southwest, in the direction of the small lakes formed from excavated sand pits.^(ref. 1) In addition, surface water drainage may also occur southwestward along Windmill Landing Boulevard toward the Harris County drainage ditch. The site is located outside the 500-year floodplain.^(ref. 1) The 2-year, 24-hour rainfall event in the area of the site is 5.5 to 6.0 inches ^(ref. 13) with an average annual rainfall rate of 44.76 inches.^(ref. 14)

The filled landfill pit (Area A, Figure 1) is located north and east of four lakes created by sand quarrying operations.^(ref. 1) The lakes have been filled by precipitation, surface water run-off and groundwater seepage.^(ref. 1) A potential surface water pathway exists that would allow surface water to drain across and through the fairly thin and, in places, breached, landfill cap material into the nearby lakes. The probable point of entry (PPE) from surface drainage is the embankments of the lakes.

The topography of the site indicates a mounding in the general location of the closed landfill.^(ref. 1, Atch. 7) Reportedly, the landfill area is slightly raised due to past closure activities.^(ref. 1, Atch. 7, p. 6) The topographic land surface reaches a maximum of 48 feet (MSL) and falls to approximately 40 feet (MSL) near the northern extremity of the site. South and west of the closed landfill area, the land surface is approximately 44 feet (MSL) so that surface water drainage patterns are west and south of the area of the landfill cap.^(ref. 1, Atch. 7, p. 6) Surface water can be expected to flow into the lakes located to the west and south of the closed landfill area, based on land surface elevations.

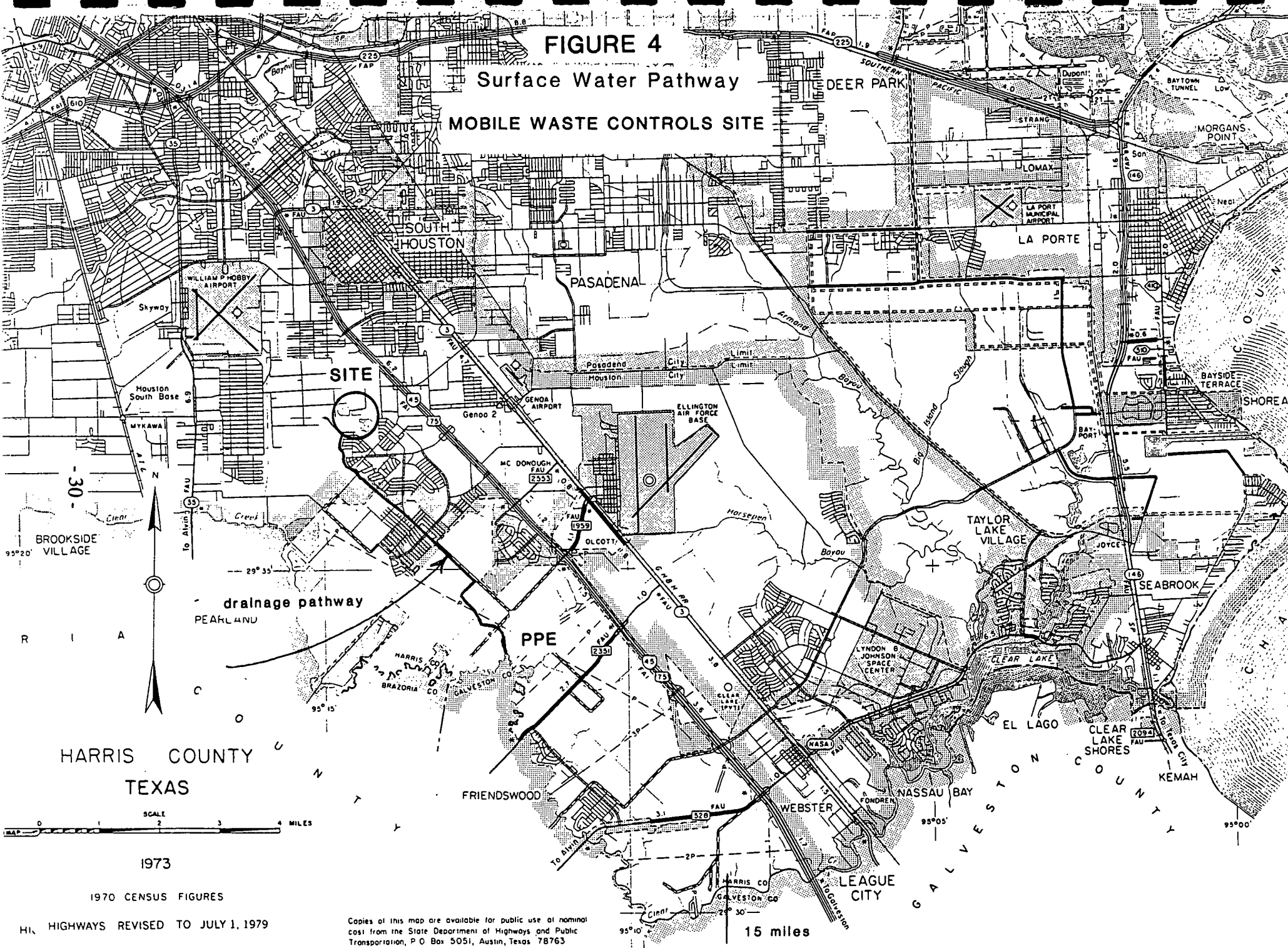
Figure 4 shows the drainage pathway of surface run-off to a Harris County Water Control and Improvement District (WCID) drainage ditch. Runoff in this drainage ditch constitutes the second potential surface water pathway. This drainage ditch is designated as intermittent on the USGS topographic map.^(ref. 17) Surface water flows in this ditch for approximately 5 miles downstream to the confluence with Clear Creek.^(ref. 1) The PPE is marked on Figure 4. From that

Table 13 Mobile Waste Controls October 1, 1985, Through September 30, 1987
TWC Water Quality Information for Segment 1102^(ref. 12)

Parameter	Criteria	Number Samples	Minimum	Maximum	Mean	Number of Values Outside Criteria	Mean Values Outside Criteria
Dissolved Oxygen (mg/L)	5.0	27	4.5	17.0	8.4	3	4.8
Temperature (°F)	95.0	27	54.3	87.8	72.1	0	0
pH	6.5 - 9.0	24	7.1	8.6	7.9	0	0
Chloride (mg/L)	200	27	31	224	137	2	218
Sulfate (mg/L)	100	25	21	120	43	1	120
Total dissolved Solids (mg/L) ¹	600	25	191	630	492	2	626
Fecal Coliforms (#/100 mL)	200	25	10	15,000	231	15	619

¹ Total dissolved solids were estimated by multiplying specific conductance by .50.

FIGURE 4
Surface Water Pathway
MOBILE WASTE CONTROLS SITE



HI, HIGHWAYS REVISED TO JULY 1, 1979

Copies of this map are available for public use at nominal cost from the State Department of Highways and Public Transportation, P.O. Box 5051, Austin, Texas 78763

point, flow is 15 miles downstream toward the Gulf of Mexico through Clear Creek Tidal (Segment 1101) and Clear Lake (Segment 2425). Since the drainage ditch is intermittent, a surface water pathway from the site to Clear Creek does not appear to exist. Drainage discharge of Clear Creek is 26,150 acre ft/yr (ref. 1, p. 20) with an average flow of about 36.1 cubic feet per second (cfs).^(ref. 1) Low flow for Segment 1102 is not known.

A third potential pathway is groundwater-surface water interaction. Precipitation and ponded surface water over the landfill will infiltrate into the landfill cover, especially in areas where the cap has been breached. Groundwater mounding was reported beneath the covered landfill area.^(ref. 1) The upper saturated sandy interval that intersects the sidewalls of the landfill pit could channel subsurface flow in the direction of local groundwater flow, potentially controlled by the groundwater mounding (recharge) noted during the investigations completed by REI.^(ref. 1) As the potentially contaminated shallow groundwater moves under the influence of hydrostatic head, the outcrop of the saturated interval along the sidewalls of the four excavated sand pit areas, now lakes, may form seeps or springs that feed the surface waters of the lakes.

Targets

The designated water uses for Segment 1101 and Segment 2425 of the San Jacinto-Brazos Coastal Basin are contact recreation.^(ref. 13) The Clear Creek Tidal segment, 14 miles in length, does include a portion of the 15 downstream miles from the site and is designated as a domestic water supply.^(ref. 12) The lakes surrounding the site are frequently used for fishing, swimming, and boating.^(ref. 1)

Threatened and endangered species within a 4-mile radius of the site are *Bufo houstonensis* (Houston Toad), *Tympanuchus cupido attwateri* (Attwater's Greater Prairie Chicken), *Opheodrys vernalis* (Smooth Green Snake), *Chloris texensis* (Texas windmill grass), *Machaeranthera aurea* (Houston machaeranthera), *Nerodia fasciata clarkii* (Gulf Salt Marsh Snake), and *Rana areolata* (Crawfish frog).^(ref. 1)

Required Information (Data Gaps)

- Consultation with the Texas Parks and Wildlife Department (TPWD) and field verification to determine the occurrence of *Bufo houstonensis* (Houston Toad), *Tympanuchus cupido attwateri* (Attwater's Greater Prairie Chicken), *Opheodrys vernalis* (Smooth Green Snake), *Chloris texensis* (Texas windmill grass), *Machaeranthera aurea* (Houston machaeranthera), *Nerodia fasciata clarkii* (Gulf Salt Marsh Snake), *Rana areolata* (Crawfish frog), endangered species, within a 4-mile radius of the site. TPWD may also provide fish production estimates for the small lakes in the drainage route from the site.
- Field determination to assess the existence of groundwater to surface water flow from groundwater seeps and springs that may enter the lakes.
- Field verification to determine the location of ditches and on-site and off-site drainage patterns in relation to the landfill cap and the lakes surrounding the site. Also, verification that the drainage ditch is not perennial stream.

- Records review to determine the flow rate for Clear Creek segment and the total basin drainage area for the Clear Creek Above Tidal segment.
- Sample data to attribute surface water pathway contaminants to the site source.

SOIL EXPOSURE PATHWAY AND TARGETS

Characteristics

During a TWC site inspection performed on April 29, 1991, stressed and bare vegetation areas were noted over the site and in the area of monitoring well 2 at the western edge of the closed landfill and adjacent to Lake Westwind.^(ref. 1, Atch. 5 and Atch. 4) These areas are potential soil exposure pathways. Surface exposed wastes and stressed vegetation have been documented at the site.^(ref. 1)

The closed, 25-acre landfill site is a maintained, open, landscaped, grass field, and public access is not restricted.^(ref. 1) Off-site runoff patterns are to the southwest and possibly to the north.^(ref. 1, Atch. 7 and Atch. 5)

The site is accessed by Windmill Lakes Boulevard, Windwater Road, East Haven Road, and Minnesota Street. There are no fences to inhibit access to the approximately 25-acre area of the closed and capped landfill (Figure 1, Area A). There is a fenced, locked, boat storage area constructed on top of the southwest corner of the closed landfill (Figure 1). Access to boating on the lakes is restricted to residents of the area. Security related to the apartment complexes is not known. Adjacent land use to the site is residential and recreational.

Targets

Three groups of apartments were constructed adjacent to the site.^(ref. 1, p. 23 and Figure 1) The approximate total population of the apartments is 1,950.^(ref. 1, p. 23) An estimated 299 total units from the three apartment complexes surrounding the closed landfill area are located within 200 feet of the site. There are no schools within 200 feet of the site.^(ref. 1) Beverly Hills Intermediate School is the nearest school and is located approximately ½ mile from the site.^(ref. 17) The enrollment at Beverly Hills Intermediate School is not known.

Terrestrial sensitive environments on or within off-site runoff pathways from the site are not known. Habitats for threatened and endangered species have been identified within a 4-mile radius of the site.^(ref. 1)

Threatened and endangered species within a 4-mile radius of the site are *Bufo houstonensis* (Houston Toad), *Tympanuchus cupido attwateri* (Attwater's Greater Prairie Chicken), *Opheodrys vernalis* (Smooth Green Snake), *Chloris texensis* (Texas windmill grass), *Machaeranthera aurea* (Houston machaeranthera), *Nerodia fasciata clarkii* (Gulf Salt Marsh Snake), and *Rana areolata* (Crawfish frog).^(ref. 1)

Required Information (Data Gaps)

- Field verification of drainage patterns and soil exposure pathways surrounding the closed landfill site.

- Sample data to determine the existence of hazardous substances in surface soils identified by stressed vegetation.
- Sample data to attribute soil contaminants to the site source, which is landfill leachate or landfill contents.
- Consultation with Texas Department of Parks and Wildlife to determine presence of terrestrial sensitive environments on or within off-site runoff pathways. Field verification required to determine if sensitive environments or endangered species exist on site.
- Verification of the distance to the nearest school or day care center and enrollment figures.
- Determination of cap thickness.

AIR PATHWAY AND TARGETS

Characteristics

Surface soil contaminated from the contaminants within the closed landfill area and volatile contaminants within the closed landfill or leachate are potential sources to the air pathway. Release of strong petroleum/chemical odors were reported from bare soil areas at the site during a November 1991 complaint investigation.^(ref. 1) Based on wind rose information for this area, dusting is anticipated to be occasional. The wind rose for Houston, presented in Figure 5, indicates that the winds are predominantly from the south and southeast, with wind speeds of 11 to 16 knots about 10 percent of the time.^(ref. 15)

The Texas Air Control Board, Austin and the District 7 (Bellaire) office, and the City of Houston, Bureau of Air Quality Control do not have reports of observed releases from the site, reports of adverse health effects, or other records on file for the site.^(ref. 16)

Targets

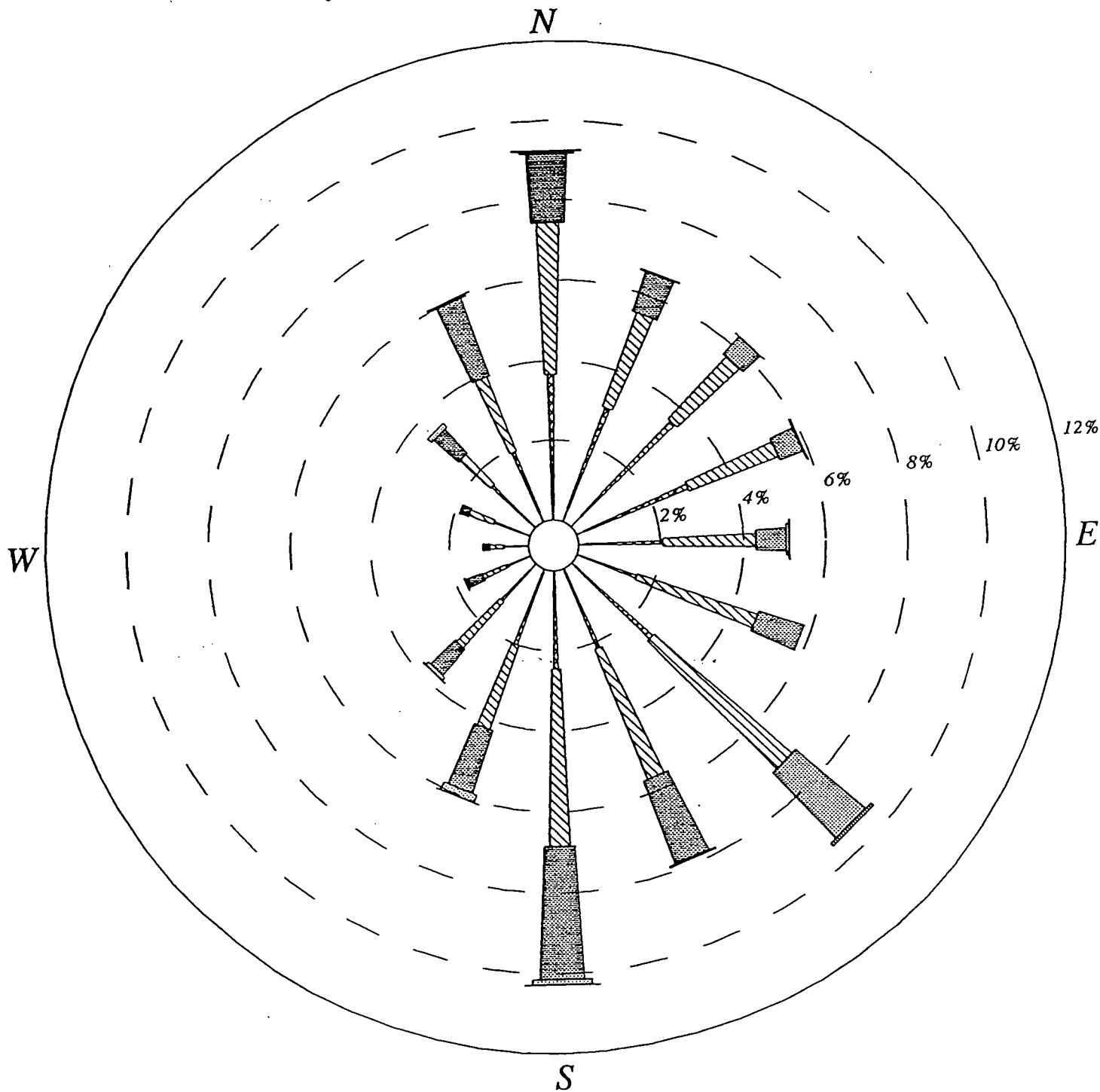
The population within a 4-mile radius of the site is estimated to be 50,000 people.^(ref. 1, p. 23) The nearest school, Beverly Hills Intermediate School, is located about 0.56 miles southeast of Windmill Lake, one of the lakes located along the southern boundary of the site.^(ref. 17) The nearest park, the Beverly Hills Park is located about 0.20 miles southeast of the site.^(ref. 17) The location of the nearest residence is the Windmill Lakes Apartments. Approximately 811 apartment units, containing 1,946 residents are located adjacent to the site.^(ref. 1) The nearest individual subject to exposure from a release of hazardous substances through the air is not known at this time. There are no National Parks or National Monuments within a 4-mile radius of the site.^(ref. 18)

Endangered or threatened species are historically known to exist within a 4-mile radius of the site, although they have not been absolutely identified as occurring within this area.^(ref. 1) Threatened and endangered species within a 4-mile radius of the site are *Bufo houstonensis* (Houston Toad), *Tympanuchus cupido attwateri* (Attwater's Greater Prairie Chicken), *Opheodrys vernalis* (Smooth Green Snake),

FIGURE 5

HOUSTON
WIND ROSE

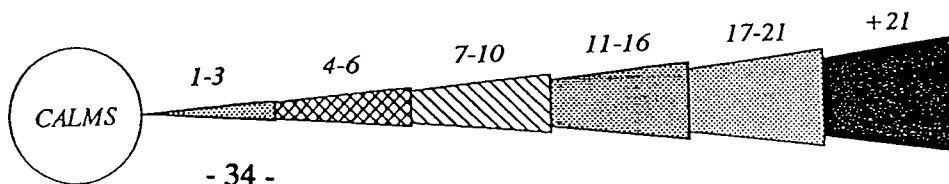
January 1-December 31; Midnight-11 PM



CALM WINDS 9.00%

WIND SPEED (KNOTS)

NOTE: Frequencies
indicate direction
from which the
wind is blowing.



Chloris texensis (Texas windmill grass), *Machaeranthera aurea* (Houston machaeranthera), *Nerodia fasciata clarkii* (Gulf Salt Marsh Snake), and *Rana areolata* (Crawfish frog).^(ref. 1) Sensitive environments have been identified within the 4-mile target distance from the site.^(ref. 1)

Required Information (Data Gaps)

- Field verification of the existence of sensitive environments within a 4-mile radius of the site, and the existence of endangered species on site.
- Field identification of the nearest resident subject to exposure from a release of hazardous substances through the air.
- Verification that there have been no reports of adverse health effects potentially resulting from releases of hazardous substances from the landfill into the air.
- Sample data from surface soil to attribute air releases to site source.

SECTION 3

SITE NON-SAMPLING DATA COLLECTION AND FIELD WORK

Engineering-Science will perform the activities described in this section to provide site background information and analytical data that can be used by the EPA to evaluate the site using the hazard ranking system (HRS). Soil, sediment, and groundwater sampling will be performed as discussed below.

All field work will be conducted in accordance with the health and safety plan (HSP) and the TWC-approved project quality assurance plan (QAPP). The HSP and QAPP are in appendixes C and D, respectively. These plans will be reviewed upon arrival at the site.

PERSONNEL REQUIREMENTS AND RESPONSIBILITIES

The TWC project manager for this screening site inspection is Allan Seils. The ES project manager is Brian Vanderglas, and Kelly Krenz of ES is the site investigation manager. ES's mailing address is 7800 Shoal Creek Boulevard, Suite 222 West, Austin, Texas 78757.

The ES site investigation manager and project manager are responsible for identifying, assigning, and organizing the staff to execute the activities required to complete the SSI. The site investigation manager is responsible for completing the activities described in this plan and adhering to the site inspection and report schedule. The schedule for activities at the Mobile Waste Controls site is presented in Table 14.

The ES project manager reviews all major reports and provides technical and administrative support to the site managers. The TWC project manager reviews the work plan and final report and approves the final versions. In addition, the TWC may provide oversight for field activities during the investigation.

COMMUNITY RELATIONS

Prior to the start of any work at the site, Engineering-Science will inform the TWC District 7 office of the field work schedule. The City of Houston and Harris County officials will also be notified, as necessary, of the investigation. ES will make no other formal notifications of SSI activities. Any requests for information which ES receives from the above will be referred to the TWC project manager unless those requests have a direct bearing on ES's ability to safely and effectively conduct the inspection. Any requests for information by the news media or parties

not associated with the site also will be directed to the TWC project manager or designee.

The TWC will provide each member of the ES inspection team and the ES project manager with letters of introduction describing the authorization given to ES personnel to conduct this SSI. The TWC will also send a notification letter to the site representatives informing them of the impending SSI field work, and obtain access authorization for ES inspectors to the site. ES will set up the site visit after receiving access authorization from the TWC.

WORK PLAN ACTIVITIES

Task 1: Nonsampling and Sampling Activities and Rationale

The field team will meet with Debbie Gomez, Environmental Specialist, of Brown and Caldwell, to access the site. Questions about past and current site operations will be addressed through a phone interview with Marty Sanderlin (TWC) if he is unavailable for the site visit, and through meetings or phone interviews with City of Houston representatives. The meeting will include a tour of the site facilities and a review of available documentation of recent site activities and hazardous substance handling practices. Other individuals who may take part in the inspection are Allan Seils (TWC Austin), Steve Hamm (TWC District 7) and Lonnie Ross (EPA Region VI).

The site manager will record observations in a logbook, while the second ES representative monitors the air with a photoionization detector (PID), flame ionization detector (FID), methane gas detector or Mini-Ram. Hand augers will be used to determine if the cap over the site is less than 1-foot thick. Adjacent properties and other nearby sites of interest, including possible water wells, will be reviewed during reconnaissance activities, and details relating to the presence of sources or pathway to or from neighboring sites will be documented.

Upon completion of the site reconnaissance, the field team will review the tentative sampling plan. The sample locations will be adjusted as necessary to ensure that the samples provide sufficient data for a complete evaluation of the site. Photographs will be taken to document site conditions and support observations reported in the log book.

Photographs have particular documentation requirements. Photographs will be keyed to a site sketch to identify the direction of view and location from which each photograph was taken. At a minimum, the following will be identified in the logbook for each photograph:

- Site name
- Location
- Name of photographer
- Date and time of photograph
- Description of situation/scene photographed.

Table 14 Mobile Waste Controls Site
Field Schedule

Time	Activity
Day 1	
0800	Leave ES Houston office for the TWC
0830	Arrive at TWC
1330	Conduct interviews with TWC representatives
1430	Drive to site; conduct perimeter survey
1800	End of day
Day 2	
0730	Review health and safety plan
0900	Meet with site personnel. Conduct interview and site reconnaissance
1200	Lunch
1300	Complete site visit. Review and modify onsite sampling plan Begin soil sampling, if possible.
1400	Begin obtaining permission to sample offsite wells or locations, if any
1800	End of day
Day 3	
0730	Review health and safety and sampling plans
0830	Onsite sampling and sample packaging
1200	Lunch
1300	Offsite sampling and sample packaging
1700	Sample shipping (Federal Express drop-off in Houston near Hobby Airport by 2015 Monday through Friday; 1700 on Saturday)
1800	End of day
Day 4	
0730	Review health and safety and sampling plans
0830	Complete on- or off-site sampling and packaging, as necessary
1200	Lunch
1300	Sample shipping
1900	End of day

This section describes the tentative sampling program for this SSI. This program will be modified if necessary depending on the results of the site reconnaissance and offsite access of sampling locations. The samples to be collected and sample rationale are listed in Table 15. Proposed sample analyses and container and preservation requirements for the soil and groundwater samples are shown in Tables 16 and 17, respectively. Sampling locations will be confirmed or determined during the site reconnaissance.

Source Hazardous Material/Contaminant

The primary contaminants of concern at the site are benzene, toluene, ethylbenzene, 2-nitropropane, chlorobenzene, cyclohexane, xylene, aniline, naphthalene, 1,4-dichlorobenzene, 1,1'-diphenylhydrazine, N-nitrosodiphenyl amine, 2-methyl phenol, 2,4-dimethyl phenol, 2,3 dimethyl phenol, diethyl phthalate, styrene, and metals. To address the contaminants of concern, the laboratory will perform EPA-stipulated Contract Laboratory Program (CLP) analytical methods on all samples collected. A formal list of these analytical methods are specified under the CLP routine analytical services (RAS) contract.

Groundwater Pathway

Nonsampling data to be collected includes:

- The location of existing wells, especially within a 1-mile radius of the site, and the population served by these wells will be determined by a well survey. Water level measurements, well construction details, well development procedures, water quality test results, and aquifer pumping data, if available, will be obtained from the well owners or Brown and Caldwell during this water well survey.
- Water level measurements will be obtained from those monitoring wells screened within the uppermost saturated interval (approximately 8 to 15 feet below surface) and will be used to construct groundwater elevation maps to determine the shallow groundwater flow direction. In addition, survey data will be obtained either from consultants or by performing a survey on the site monitoring wells. The survey on site will likely determine only the relative elevations of the monitoring wells, and not their exact elevation with respect to mean sea level. This will still allow for the determination of the groundwater gradient.
- Groundwater samples from four domestic water supply wells within one-half mile of the site will be obtained to characterize the quality of nearby drinking water supplies and determine whether downward and outward migration of contaminants has contaminated drinking water supplies in the vicinity of the site. The four domestic water supply wells to be sampled, located at 9913 East Haven Road (65-31-1B), 9421 Lambright Road (65-31-1C), 9905 Radio Road (65-31-4C), and 9205 Wayfarer (65-30-3), are screened at three different aquifer intervals (88 to 94, 325 to 345, and 444 to 454 feet below surface).

Samples collected from the domestic wells located on East Haven and Lambright roads will be designated as sample number GW-1 and GW-2, respec

Table 15 Proposed Samples to be Collected at Mobile Waste Controls Houston
Harris County, Texas TXD 988051652

Sample Matrix	Sample ID	Sample Locations	Rationale
Soil	SO-1	Stressed soil area near potential cap cracks on northeast portion of cap.	Assess soil contamination for source characterization from near landfill cap cracks as reported by the TWC.
	SO-2	Stressed soil area near potential cap cracks on southern portion of cap.	Assess soil contamination for source characterization from near landfill cap cracks as reported by the TWC.
	SO-3	Background soil location upgradient from site.	Establish background conditions of soil.
	SO-4	Stressed soil near MW-2.	Assess soil contamination and extent for source characterization from near landfill cap cracks as reported during PA.
	SO-5	Stressed soil near MW-2	Assess soil contamination and extent for source characterization from near landfill cap cracks as reported during PA.
	SO-6	Stressed soil near MW-2.	Duplicate soil sample collected at same location as SO-4 soil sample.
	SO-7	Upgradient location of PPE into Windmill Lake	Assess conditions of drainage path upgradient of PPE into Windmill Lake.
	SO-8	Upgradient location of PPE into Lake Westwind	Assess conditions of drainage path upgradient of PPE into Lake Westwind.
	SO-9	Upgradient location of PPE into Bass Lake	Assess conditions of drainage path upgradient of PPE into Bass Lake.
	SO-10	Upgradient of PPE in 4th lake	Assess conditions of drainage path upgradient of PPE into Bass Lake.
Groundwater	GW-1	9913 East Haven, well 65-31-1B	Assess groundwater in nearest domestic well screened at 88-94 feet.
	GW-2	9421 Lambright Road, well 65-31-1C	Assess groundwater in domestic well screened at approximately 88-94 feet.
	GW-3	9205 Wayfarer well 65-30-3	Assess groundwater in domestic well located approximately 1/2 mile from the pit and screened at 444-454 feet below surface.
	GW-4	9905 Radio Road well 65-31-4C	Assess groundwater in domestic well located approximately 1/2 mile from the site and screened at 325-345 feet below surface.

Table 15, continued

Sample Matrix	Sample ID	Sample Locations	Rationale
Sediment	GW-5	Monitoring well 2 on southwest corner of pit	Assess uppermost saturated interval at perimeter of pit on presumed down-gradient side to determine if contaminants are potentially migrating off site.
	GW-6	Monitoring well 8 on southeast corner of pit	Assess uppermost saturated interval on southeast corner of pit to determine potential for offsite migration of contaminants to the south.
	GW-7	Monitoring well 7 on northeast corner of pit	Establish upgradient conditions in uppermost saturated interval.
	GW-8	Monitoring well 5 on northwest corner of pit	Assess uppermost saturated interval at perimeter of pit on presumed down-gradient side to determine if contaminants are potentially migrating off site.
	GW-9	9913 East Haven well 65-31-1B	Duplicate groundwater sample for QA/QC.
	SE-1	Sediment in Windmill Lake	Assess whether contaminants have been released to surface water at Windmill Lake.
	SE-2	Sediment in Lake Westwind	Assess whether contaminants have been released to surface water at lake westwind.
	SE-3	Sediment in Bass Lake	Assess whether contaminants have been released to surface water into Bass Lake.
	SE-4	Sediment in Lake Westwind	Duplicate sediment sample for QA/QC. Collected at same location as SE-2.
Surface water	SW-1	Windmill Lake	Assess whether contaminants have been released to surface water in Windmill Lake.
	SW-2	Lake Westwind	Assess whether contaminants have been released to surface water in Lake Westwind.
	SW-3	Bass Lake	Assess whether contaminants have been released to surface water in Bass Lake.
	SW-4	4th Lake	Assess whether contaminants have been released to surface water in the 4th Lake.
	SW-5	Lake Westwind	Duplicate surface water sample to QA/QC.

Table 16. Sample Containers, Methods, Preservatives, and Holding Times for Soil/Sediment Samples

Parameters	Sample Container	Preservative	Holding Time
Volatile organics	Two 120-mL glass vials with Teflon-lined septa	Cool to 4 °C	14 days
Semivolatile organics	8-ounce widemouth glass jar with Teflon-lined lid	Cool to 4 °C	Extract within 14 days of collection, and analyze within 40 days of extraction.
Pesticides/PCBs	8-ounce widemouth glass jar with Teflon-lined cap	Cool to 4 °C	Extract within 14 days of collection and analyze within 40 days of extraction.
Metals	8-ounce widemouth glass jar	Cool to 4 °C	180 days after collection
Cyanide	8-ounce widemouth glass jar	Cool to 4 °C	14 days

* Reference: EPA Contract Laboratory Program Statement of Work for Organics Analysis (March 1990) and Statement of Work for Inorganic Analysis (March 1990).

Table 17. Sample Containers, Methods, Preservatives, and Holding Times for Aqueous Samples

Parameters	Sample Container	Preservative	Holding Time
Volatile organics	Two 40-mL glass vials with Teflon-lined septa	Cool to 4° C	7 days
Semivolatile organics	Two 1-liter amber glass bottles with Teflon-lined caps	Cool to 4° C	Extract within 7 days of collection, and analyze within 40 days of extraction.
Pesticides/PCBs	Two 1-liter glass bottles with Teflon-lined cap	Cool to 4° C	Extract within 7 days of collection and analyze within 40 days of extraction.
Metals	One 1-liter plastic bottle	HNO ₃ to pH < 2	6 months (except mercury*)
Cyanide	One 500-mL plastic bottle	NaOH to pH > 12 Cool to 4° C	14 days

* Reference: EPA Contract Laboratory Program Statement of Work for Organics Analysis (March 1990) and Statement of Work for Inorganic Analysis (March 1990).

tively (Figure 6). The sample collected from the domestic well located on Wayfarer Road (65-30-3) will be designated as sample number GW-3. A fourth groundwater sample (GW-4) will be collected on Radio Road. The duplicate groundwater sample collected for QA/QC purposes, GW-9, will be collected from the well located on East Haven, which is the nearest domestic well to the site.

If wells are identified closer to the site than those already identified, then the plan will be modified to sample the nearest well from each water producing zone. The well purging and sampling procedures are dependent on the type of well and are discussed in the QAPP.

For domestic wells, if practical, three volumes (well volume and holding tank volume) of water will be evacuated from the well prior to sampling. If the system volume is unknown, a tap will be opened and allowed to run for 15 minutes prior to sampling. Samples will be collected from a point as close to the well as possible and before the water is processed through any treatment devices. Conductivity, temperature, and pH will also be measured during purging activities. Samples will not be collected from a faucet equipped with an aerator.

Four groundwater monitoring wells installed to monitor site conditions will also be sampled in order to establish the quality of the shallow saturated interval in the vicinity of the landfill. Monitoring well 7 (GW-7), if identified in the field, will be sampled. MW-7 will be sampled to serve as probable upgradient well. Groundwater samples will also be collected from monitoring well 2 (GW-5), monitoring well 5 (GW-8), and monitoring well 8 (GW-6). MW-2 and MW-5 will be sampled because the groundwater sampling program undertaken by the TWC, the city of Houston, and the FDIC identified contaminants of concern present in the groundwater collected from these wells. MW-8 will be sampled because of its proximity to Windmill Lake and the fourth unnamed lake.



Specific requirements for the determination of the presence of immiscible organic contaminants and the volume of water to be removed during well purging will be identified at the time of well sampling.

Surface Water Pathway

Nonsampling data to be collected includes:

- Fish production from nearby lakes will be confirmed through on-site interviews and interviews with TPWD.
- The occurrence of endangered and terrestrial species within a 4-mile radius of the site will be verified through consultation with the Texas Parks and Wildlife Department and through visual observation during the site reconnaissance.
- Recreational uses of surface water will be determined through observation and interviews.
- The location of ditches and surface water bodies, and on-site and off-site drainage patterns, will be verified during the site reconnaissance survey. The

LEGEND

-  APPROXIMATE AREA OF CLOSED LANDFILL
- * UNDOCUMENTED HOUSE NUMBERS
LOCATION TO BE VERIFIED
- NA NOT AVAILABLE
-  GROUNDWATER SAMPLE LOCATION

WELL DESIGNATIONS-ADDRESSES

- GW-1 = 9913 EAST HAVEN
- GW-2 = 9421 LAMBRIGHT
- GW-3 = 9205 WAYFARER
- GW-4 = 9905 RADIO ROAD

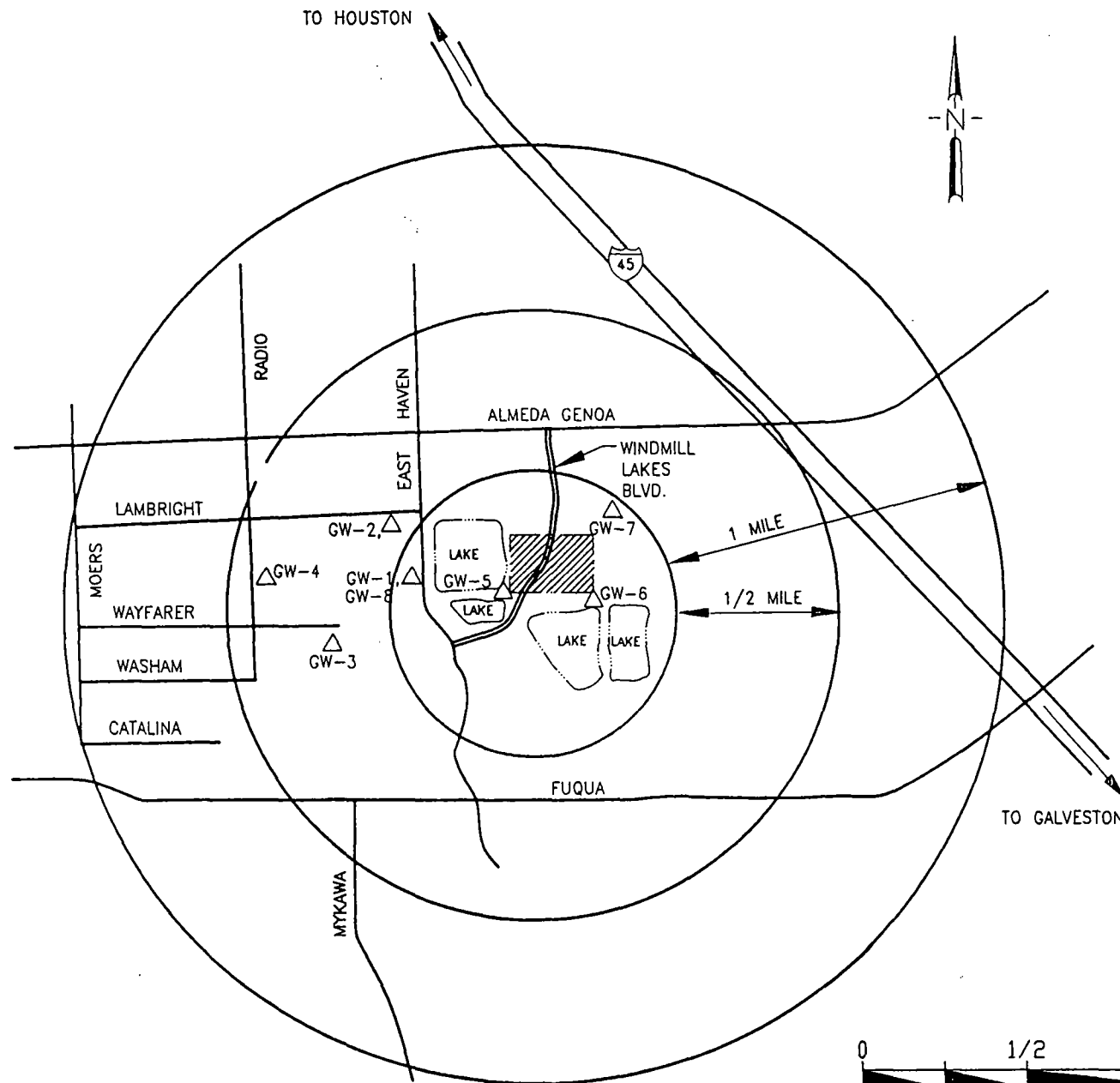


FIGURE 6

PROPOSED GROUNDWATER
SAMPLING LOCATIONS
MOBILE WASTE CONTROLS
TEXAS WATER COMMISSION

drainage ditches providing surface water drainage pathways in the vicinity of the site will be investigated and determined to be intermittent or perennial.

- A document and records review will be completed to determine the flow rate for the Clear Creek segment and the total basin drainage area for the Clear Creek Above Tidal segment.

Both surface water and sediment samples will be collected to address the surface water pathways. Four surface water samples will be collected, one in each lake. SW-1 will be collected in Windmill Lake. SW-2 will be collected in Lake Westwind. SW-3 will be collected in Bass Lake. SW-4 will be collected in the fourth lake. In addition, a duplicate sample, SW-5, will be collected in Lake Westwind. A surface water dipper will be used to collect the water samples from a boat on each lake, as described in the QAPP.

Soil and sediment samples will also be collected to investigate the potential for releases to the surface waters of the four lakes surrounding the site. The contaminant pathways to be investigated are the seepage of shallow, potentially contaminated groundwater or landfill leachate through the subsurface to the lakes and the runoff of surface water over potentially contaminated surface soils into the lakes. The four pits that are now filled with water are considered to be small lakes that may be fed by water from springs or seeps that may be impacted by the contaminants buried in the closed landfill excavation.

One soil sample will be taken along the embankment leading into each lake (SO-7 through SO-10), and one sediment sample will be taken in three of the lakes (SE-1 through SE-4). These sediment samples will be obtained in order to investigate the potential sediment pathway described along the intersection of the shallow, water-bearing interval with the excavation wall of each lake. A duplicate sediment sample (SE-4) will be collected in Lake Westwind. Approximate sample locations are shown on Figure 7.

Sediment samples will be collected from the bottom of Windmill Lake (SE-1), Lake Westwind (SE-2), and Bass Lake (SE-3) with a dredge sampler. Excess water will be drained from the samples. Next, the samples will be placed in the appropriate jars, as described below for soil samples.

Soil Exposure Pathway

Nonsampling data to be collected includes:

- Drainage patterns and soil exposure pathways surrounding the landfill site will be obtained during the site reconnaissance survey.
- Distance to nearest school will be verified during the site survey.

Up to five soil samples, including one background sample (SO-3) and one duplicate soil sample (SO-6), will be collected in areas of stressed soil or observed landfill cap cracks. Approximate soil sample locations are shown on Figure 7. SO-1 and SO-2 will be collected in areas near reported landfill cracks. At least one sample will be collected within 200 feet of the nearest residence. Samples SO-4 and SO-5 will be collected in the vicinity of MW-2, where vegetation was reportedly

LEGEND

- APPROXIMATE BOUNDARY OF CLOSED LANDFILL BASED ON AIR PHOTO (DEC. 1973).
- FENCE LINE
- △ SO-2 SOIL SAMPLE LOCATION AND NUMBER
- △ SE-2 SEDIMENT SAMPLE LOCATION AND NUMBER
- △ SW-2 SURFACE WATER SAMPLE LOCATION AND NUMBER
- ⊕ MW-2 MONITORING WELL LOCATION AND NUMBER

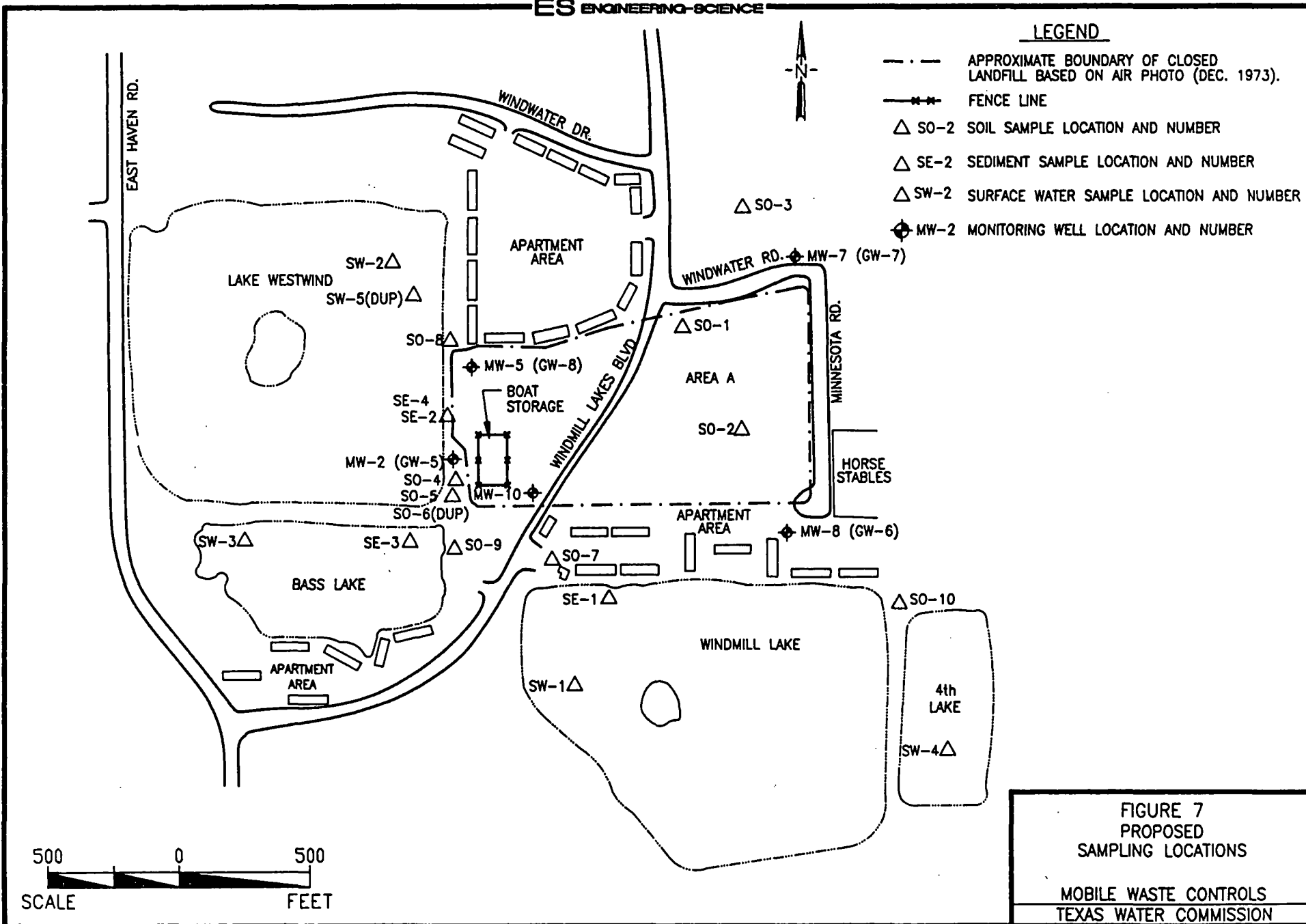


FIGURE 7
PROPOSED
SAMPLING LOCATIONS

MOBILE WASTE CONTROLS
TEXAS WATER COMMISSION

500 0 500
SCALE FEET

stressed. The exact locations will be determined in the field based on field observations described below. Sample SO-3 will serve as background for both soil and sediment sampling and will be collected in a location upgradient to the pathway associated with Lake Westwind. The sampling locations will be adjusted so that observed areas of contamination, as identified by stressed soil, visible soil staining, or visible leachate collection at the surface, are sampled.

Soil samples will be collected within 6 inches of the upper soil surface. Sampling will be performed with a dedicated trowel or small shovel. The samples will be collected from a depth as close to the surface as possible, yet deep enough to avoid grass and roots. Samples will be placed in glass jars as specified by the CLP and the QA plan and sealed with Teflon-lined lids. Organic samples will be placed in one 8-ounce, wide mouth glass jar and two 120-mL, wide mouth glass vials. Inorganic soil samples will be placed in one 8-ounce, wide mouth glass jar or two 4-ounce, wide mouth glass jars. No headspace will be left in the VOA sample jars. Sample jars will be marked for identification and placed on ice for preservation. Identification markings will include site location, sample number, date and time of collection, and names of samplers.

To avoid cross contamination of samples, dedicated sampling equipment will be used. Decontamination procedures are described in the approved QAPP. Proper sample containers, preservation, and holding times for CLP soil samples are presented in Table 16.

Air Pathway

Nonsampling data to be collected include:

- The location of the nearest resident to the site by on-site reconnaissance or off-site survey.
- Verification of no reports of adverse health effects due to releases of hazardous substances in the air at the site by site interviews and a review of Public Health Department records.
- Field verification should be attempted during peak rainfall event to assess the presence of odors near MW-2 as reported in previous field investigation.

No air samples are planned to assess releases to the air pathway; however, results of surface samples collected for soil exposure and surface water pathway will be used to assess potential for releases to occur to air pathway. In addition, a field PID used for health and safety will provide an indication of the presence of volatile organic compounds in the air at the site. The PID will be used near MW-2, since the PA indicated the presence of odors in this vicinity.

Quality Assurance/Quality Control Samples

Two types of QA/QC samples will be used in this sampling inspection. Duplicate samples will be taken at a rate of one duplicate per matrix (groundwater, if applicable, and soil-sediment). In addition, trip blanks will be collected.

Trip blanks are used to determine if samples are affected by airborne volatiles that pass through the Teflon-lined septum of the sample container. Trip blanks will

be prepared in the laboratory by filling two or three 40-milliliter volatile sample vials with organic-free water. The trip blanks will accompany the empty bottles shipped to the field and will be kept with the samples during collection and shipment to the laboratory. They will be analyzed for the volatile organics only.

Task 2: Decontamination Procedures

Equipment Decontamination

Proper decontamination procedures will aid in preserving the representativeness of the samples collected. Dedicated sampling spoons or trowels will be used to collect each soil or sediment sample at the site. These spoons will be decontaminated prior to arrival at the site and sealed in plastic sealable bags in accordance with the quality assurance project plan. After sampling, gross contamination (visible) will be removed from the sampling equipment and the equipment will be decontaminated by detergent wash and distilled water rinse. The equipment will receive a more thorough decontamination at a location away from the investigated site in accordance with the QAPP. The outside of the sample containers will be rinsed and wiped clean prior to packing in coolers for shipment.

Personal Decontamination

Decontamination fluids used to clean equipment will be disposed of on site in the approximate area of the sampling location in accordance with investigation derived waste (IDW) guidelines. Equipment decontamination will not be necessary in the case of any domestic wells sampled, since water is collected directly from a tap. All disposable clothing (Tyvek, gloves, etc.) will be shredded prior to disposal to prevent reuse. Boots will be scrubbed with soap and brush and rinsed with potable or distilled water in a tub. Decontamination fluids from the rinse will also be disposed of on site. The location of IDW disposal will be described in the field log book.

Task 3: Sample Shipping

During sampling activities, the samples will be packed and preserved according to procedures described in the QAPP. The outside of sample containers will be washed on site and wiped clean prior to packing into the cooler for shipment. The project team will complete the paperwork necessary to ship samples to CLP laboratories for analytical testing. The field team will request RAS 14-day turnaround from the CLP laboratory. The sample handling and custody requirements are discussed in greater detail in the QAPP.

Samples will be shipped and delivered to the designated laboratory for analysis daily. The overnight freight courier pickup and office schedule in the area of the site is:

Federal Express
8200 Telephone Road
Houston, Texas
Last drop off at 8:15 P.M. Monday through Friday; 5:00 P.M. Saturday

During sampling and sample shipment, the ES field team leader (or his designee) will contact the CLP sample management office 703/557-2490 or 703/684-5678 to inform them of shipment.

The samples will be shipped in ice chests by overnight courier such as Federal Express. The chain-of-custody forms will be placed within the chest in this case, and the shipper will receive a chest which is sealed with tamper-resistant tape. The tamper-resistant seal is paper or plastic tape which cannot be removed without tearing it. The seals will be signed by the sample custodian shipping the samples.

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4. 55 FR 30798, EPA Proposed Corrective Action Rule for Solid Waste Management Units, July 27, 1990.
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13. Technical paper number 49, *Two to Ten Day Precipitation for Return Periods of Two to One Hundred Years in the Contiguous United States*, U.S. Department of Commerce, 1964.
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17. U.S. Geological Survey Map, Friendswood Quadrangle, 1982.
18. National Park Service, Santa Fe, New Mexico, *National Parks in Texas* brochure.

Appendix A

**Preliminary Assessment
(narrative)**

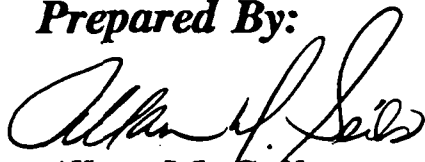
PRELIMINARY ASSESSMENT:

*Mobile Waste Controls, Inc.
Harris County, Texas*

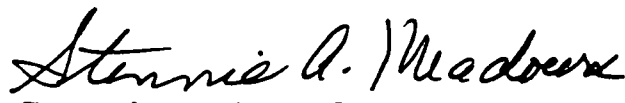
December 19, 1991

Texas Water Commission

Prepared By:


Allan M. Seils
Site Coordinator

Reviewed and Approved By:


Stennie A. Meadours
***Manager, Emergency Response
And Assessment Section***

**PRELIMINARY ASSESSMENT
NARRATIVE**

Site: Mobile Waste Controls, Inc.

Date: 12/19/91

I. Site Information

The site is located at Latitude 29 37' 19" N, Longitude 95 13' 59" W west of 10000 Minnesota Street in the City of Houston, Harris County and is approximately 25 acres in size.

In the late 1960s, the rural area located half a mile west of the intersection of Almeda-Genoa Road and IH 45 was an active sand quarry. In August 1967 the site was being operated by Union Sand and Rental Company and Carson Gibson. A review of aerial photography confirmed sand quarrying had begun as early as October 31, 1962 (Attachment 6). A series of deep pits were excavated: two large (Figure 1 - Lakes B and D at 1,000 feet diameter); two small (Figure 1 - Area A and Lake C at 300 feet diameter); and one shallow (Figure 1 - Lake E). Area precipitation and ground water accumulated in these pits to form a series of lakes (Ref. 18).

From 1969 through 1981, the property was owned by Realty Reclamation, Inc. and operated as an industrial and commercial landfill by Wallace Waste Control Company, Metropolitan Waste Conversion, National Disposal Contractors, and Mobile Waste Controls, Incorporated (Ref. 18 Document 1). By 1972, one of the unlined small pits (Figure 1 - Area A) had been filled to two thirds full with a variety of industrial and commercial wastes (Ref. 18 Document 36). City of Houston representatives documented a variety of operational violations at the site including: 1) receipt of industrial chemicals, municipal and putrescible wastes; 2) several fires; and 3) odor problems (Ref. 18 Documents 33 and 35). The site was closed under a permanent injunction issued by the District Court due to action sought by the City of Houston in 1974 (Ref. 18 Document 46).

In 1982 Levering & Reid created Windmill Lakes Subdivision and constructed three apartment complexes among the property bordering the lakes. Windmill Lakes Blvd. was constructed over the landfill site (Refs. 18 Documents 65-68 and Attachment 5). The landfill cap was disturbed by surveying and construction resulting in exposed waste material (Ref. 18 Document 45). REI (Resource Engineering), hired by Levering and Reid (Attachments 7 and 8), and the City of Houston Public Health Department conducted joint ground water monitoring at the site during 1982 and 1983. Sample results indicated elevated concentrations of Total Suspended Solids (TSS), Total Organic Carbon (TOC), Chemical Oxygen Demand (COD), and the presence of Benzene, Toluene and several complex organic compounds in the monitoring wells (Ref. 18 Documents 84-87). The site

Site: Mobile Waste Controls, Inc.
Date: 12/19/91

reports reviewed indicated monitoring at the site was to continue for 20 years (Ref. 18 Document 69), however, no documentation of any site activities was found in the records reviewed during the 1984 - 1991 period.

Texas Water Commission site inspections of April 29, 1991 and October 9, 1991 found the landfill area to be a maintained grass field transected by Windmill Lakes Blvd. with a boat storage area located on the western edge of the site (Attachment 5, Photographs 1-11). The site is bordered by a horse stable (east), an undeveloped area (north), Windmill Lakes Apartments (south), and a large lake (west).

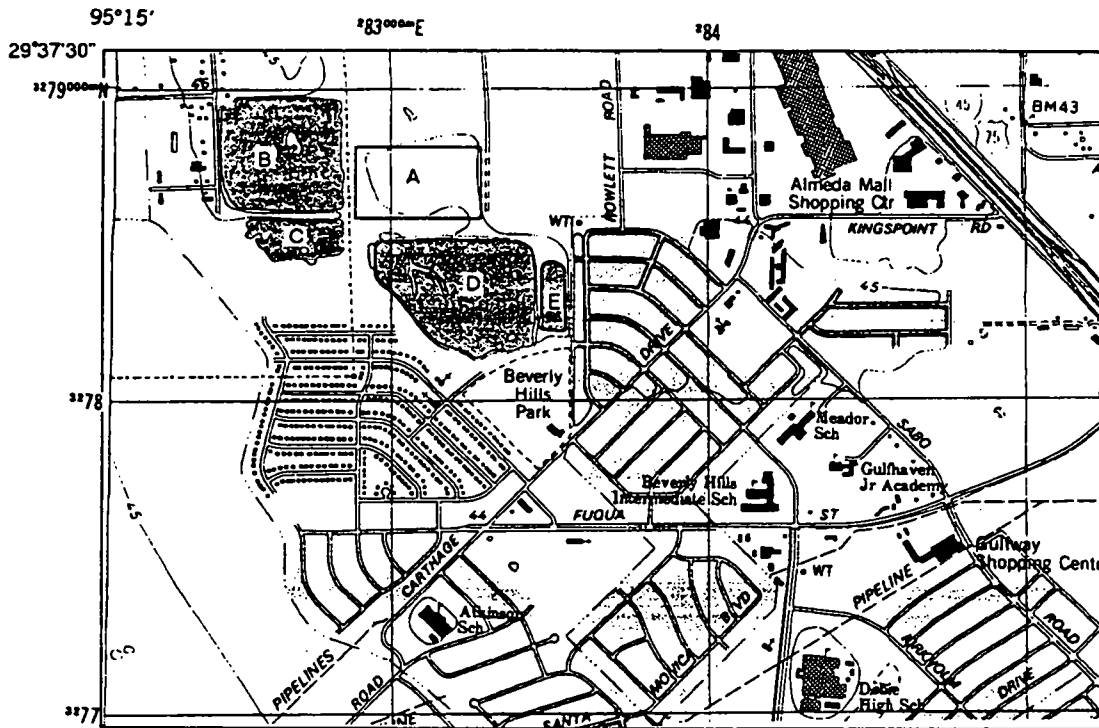


Figure 1 Mobile Waste Controls, Inc., Houston, Texas, Harris County, old landfill (Area A). Windmill Lakes identified as B, C, D, and E.

Site: Mobile Waste Controls, Inc.
Date: 12/19/91

II. Background/Operating History

NOTE: All reference materials used in compiling this background information may be found in Attachment 4 in the chronological order in which it appears below. In addition, a complete written chronology (Documents 1-92) of these records is included with the attachment. Mr. Antonio Mora, City of Houston, 711 Park Place, Houston, Texas (713/640-4399) maintains additional historic files on this site, including many photographs depicting site conditions during its operational years.

The earliest report of industrial waste disposal at the site was submitted on September 6, 1970 by Mr. E. J. Bray, 9810 Almeda-Genoa Road, to the City of Houston Public Health Department. He provided a copy of a November, 1969 Texas Water Development Board report on "Possible Contamination of Groundwater by Sand Quarrying Operations in Southeast Houston, Harris County, Texas". The report contained information provided by Mr. Bray that it was not unusual for oil field and chemical plant wastes to be dumped into the 4 sand pits (Easthaven Sand Pit) and that as early as 1967 processed material (refuse) from a compost plant was also dumped near his home. At the time of the field investigation for this report (August, 1967), the site was being operated by Union Sand and Rental Company and Carson Gibson. When the pits were examined on August 11, 1967, the water table had been penetrated in the pits; one pit had received a large amount of refuse; chemical analyses of inorganic constituents in water samples from 6 wells and 2 of the pits were similar; water from the pits would move slowly southeast in direction of ground water movement; and possibly heavy pumping of the wells adjacent to the north and northwest sides of the pits could cause a reversal of the direction of ground water movement locally and the movement of some water from these pits to these wells (A correlation of these pits with Figure 1 could not be made as the figures referenced in Document 25 were unavailable). The report concluded that chemical analyses of water samples collected during the field investigation did not indicate that reported periodic dumping of refuse and plant wastes into sand pits in the Easthaven area had resulted in inorganic chemical contamination of water in the pits or in nearby wells (Ref. 18 Document 25).

In late 1967 or early 1968, sand-quarrying operations ceased with the enforcement of a 1964 City of Houston Ordinance that prohibited the pumping of groundwater from the pits into ditches beside public streets (Ref. 18 Document 25).

Site: Mobile Waste Controls, Inc.

Date: 12/19/91

In a January 16, 1970 letter, Mr. Victor Brown, President, Metropolitan Waste Conversion Corporation, Houston, Texas wrote to the City of Houston to make formal application to use Lots 11 and 12, Block 17, of Genoa for a sanitary landfill. Metropolitan had recently obtained a lease from Realty Reclamation Company, 8320 Gulf Freeway, Houston, Texas, for the property. National Disposal Contractors of Barrington, Illinois had been secured by Metropolitan as consultants of the design and operation of the landfill. Only commercial and industrial waste, with the balance of material being the excess material from the Metropolitan Waste compost plant, was to be accepted as landfill material (Ref. 18 Document 1).

In a City of Houston Inter Office Correspondence of February 6, 1970, the City Public Health Department decided to issue the permit requested by Metropolitan. This was done with some hesitancy due to the poor record of indiscriminate and improper stockpiling of compost at the Metropolitan compost plant (Ref. 18 Document 3). The following conditions were recommended in granting the permit:

1. No sour nor odoriferous material be disposed at the site;
2. All material be covered at the close of each day in accordance with the practices set forth by State Department of Health;
3. The fill be done in such a manner that the buried material will not be disturbed again;
4. The fill area be kept free of water and sufficient pumping capacity be maintained at the site to do this;
5. All materials handled in such a manner as to allow no loss of particulate to be blown off-site;
6. No emission of odor be allowed; and
7. An immediate correction of any violation found or the license be revoked.

City of Houston correspondence of February 11, 1970, granted Metropolitan permission to operate the landfill subject to the above cited conditions (Ref. 18 Document 4).

In a letter of April 30, 1970, George Edema, Vice President, National Disposal Contractors, wrote to the City of Houston Public Health Department requesting the license to operate the Metropolitan landfill be transferred to National (Ref. 18 Document 5). Mr. Edema also requested a variance on from Conditions 1 and 6. In addition, National requested permission to accept at the landfill more of the material from the compost plant so that both processed and unprocessed material could be included in the landfill.

Site: Mobile Waste Controls, Inc.
Date: 12/19/91

In response to a citizens request on May 25, 1970, the City of Houston collected samples from four (4) nearby domestic wells. The well water was analyzed for bacterial contamination. An unknown level of bacterial contamination was found in the well at 9815 Radio Road. Chlorination of the well was recommended (Ref. 18 Document 8).

On July 7, 1970, Mr. Albert G. Randall, Director of Public Health, City of Houston, notified Metropolitan that several recent inspections by the City's Air Pollution Control Program found emissions of sour odor and that the sanitary landfill conditions observed were inconsistent with the provisions established for operation of the site (Ref. 18 Document 11).

On August 4, 1970, Realty Reclamation, Incorporated submitted a request to the City of Houston Health Department to make the site available for all types of industrial commercial refuse. Borings accompanying this request identified 29 to 36 feet of impermeable clay at the site with a silty sand layer at 8 to 8.5 feet and a medium dense red silty sand seam at 10 to 12 feet. The report recommended sealing the thin sand strata with two feet of compacted clay on the edges of the excavation to insure impermeability (Ref. 18 Document).

On August 11, 1970, a joint investigation by the City of Houston, Texas Department of Health, and Texas Water Quality Board was conducted at the 20 acre proposed landfill site. The area to be used was an old pit (Figure 1 - Area A east side), most of which was approximately 8 feet deep. A deeper pit of unknown depth which penetrated the ground water was also present (Figure 1 - Area A southwest corner). The report concluded the site would be satisfactory for the proposed receipt of municipal type refuse provided: 1) the deep area be provided with an impervious cover; and 2) all requirements of a sanitary landfill be met (Ref. 18 Document 19).

On August 26, 1970, Realty Reclamation, Inc. was notified of the inspection findings and advised to proceed as long as the site was handled in a sanitary manner and in compliance with State Health Department regulations and City of Houston codes (Ref. 18 Document 21).

In letter of September 10, 1970, Realty Reclamation, Inc. notified the City of Houston Public Health Department that they would only accept industrial and commercial waste for landfill purposes (Ref. 18 Document 27).

Site: Mobile Waste Controls, Inc.
Date: 12/19/91

Texas Water Quality Board correspondence of October 2, 1970 notified the Texas Department of Health that the site would be suitable for the disposal of municipal refuse only provided the narrow layers of perched water tables between dense layers of clay are sealed off with a minimum of three feet of compacted clay material. The disposal of industrial toxic and organic material was to be prohibited (Ref. 18 Document 29).

In a letter of January 19, 1971, National Disposal Service notified the City of Houston that its land lease with Realty Reclamation Service had expired and they had not engaged in sanitary landfill activities at the site since December 20, 1970 (Ref. 18 Document 31).

On April 30, 1971, the Texas Department of Health inspected the Wallace Waste Control solid waste disposal site located on Minnesota Street (Ref. 18 Document 33). The results of the inspection were:

1. municipal type refuse had been received at the site until March 29, 1971; and
2. the deep pit (Figure 1 - Area A southwest corner), described as pit number 3 in the southwest corner of the present site, had not been sealed as previously recommended.

The site operators were directed to:

1. discontinue placing refuse in water;
2. close the levee between pits 1 and 2 (Figure 1 - Area A west side);
3. dewater pit 1 to another pit (pits 2 or 3) or the adjacent pond (Figure 1 - Lake B) and install an adequate seal; and
4. place a levee between pits 2 and 3.

On February 22, 1972, the Texas Water Development Board issued a Groundwater-Contamination-Investigation Report, Project No.: CI-7203, entitled: Possible Groundwater Contamination From The Wallace Waste Control Company's Sanitary-Landfill Operation Near The East Haven Area of Houston, Harris County, Texas (Ref. 18 Document 36). The investigation was initiated following the receipt of a letter from Mr. E. J. Bray dated December 14, 1971 by the Board regarding possible ground water pollution from the site (Ref. 18 Document 36). The Board found the following:

1. The original pit (Figure 1 - Area A) used as a landfill at this site was approximately 15 to 20 feet deep and was about two-thirds filled with refuse and cover material. Seepage and rainwater had collected in the unfilled west end of the pit.

Site: Mobile Waste Controls, Inc.

Date: 12/19/91

This water was being pumped out at an estimated rate of 500 to 1000 gallons per minute into the adjacent pit (Figure 1 - Lake B) west of the landfill. Recently deposited waste at the site consisted of a variety of industrial and commercial wastes such as wood, paper, plastics, rubber, metal, and occasionally garbage. Mr. Buck Hausman, one of the site owners, stated that the site ceased the acceptance of wastes in sealed containers due to some unfortunate experiences with dangerous chemicals (Ref. 18 Document 36).

2. Wallace Waste Control Company now proposed to use a part of the deeper sand pit (Figure 1 - Lake B) to the west of the original pit to expand its landfill operations. Water standing in this pit was to be contained in the unused part of the pit (west side) or pumped to a Harris County Water Control and Improvement District drainage ditch nearby.
3. Water samples were collected for inorganic chemical analysis from several area domestic wells and surface water of the local pits to supplement data obtained during the Board's pervious investigation in 1967. A comparison of the 1967 and 1972 analyses of water sampled from common wells did not reveal an increase in any inorganic chemical constituents that might be indicative of contamination. Water samples from the original landfill pit (Figure 1 - Area A) revealed sulfate content which was more than four times as great as the sulfate content of any other surface or groundwater sample obtained in either 1967 or 1972. (Note: The report also references a report entitled: Subsurface Exploration, Hausman Sand Pit, Houston, Texas, prepared by Southwestern Laboratories, Soils and Foundation Division which is attached to Ref. 18 Document 42).
4. Prior to the 1967 investigation, water level declines in some wells had been caused by the continuous pumping of water from the deep pit (Figure 1 - Lake B) proposed for expanded landfill activities. Evidence of pit water and nearby well communication was found in the 1972 investigation. The report noted some rise in the area water table due to recharge from precipitation and cessation of pumping from this pit in late 1967.
5. The 1972 investigation report concluded that the pit (Figure 1 - Lake B) west of the original landfill site now proposed for a landfill could not be effectively sealed from ground water infiltration because of hydrostatic-pressure differences between the pit bottom and the natural water table. Further, any polluted ground water would move southeastward in the

Site: Mobile Waste Controls, Inc.
Date: 12/19/91

general direction of ground water movement as the present rates of ground water withdrawal north and northwest of the pit was not high enough to reverse its direction. Finally, the average depth of pit proposed for a landfill was 40 to 44 feet below the water table of the shallow aquifer in the area, therefore, landfill operations were not recommended for that pit, or any nearby abandoned sand pit extending below the water table.

The City of Houston, however, continued to find problems at the site. In a March 20, 1972 letter (Ref. 18 Document 32) to Councilman Frank Mancuso, the City reported:

1. the site was being operated by Mobile Waste Control, operating as Wallace Waste Control;
2. a March 16, 1972 inspection of the site showed large areas of the site contained uncovered refuse and some garbage;
3. 8 complaints were received about smoke from the site about 5-6 pm, March 17, 1972 with the fire being extinguished by 6:00 am March 18, 1972. Weekly inspections of the site were to be made thereafter.

In an April 7, 1972 letter Mr. Bray reported the site to be essentially filled, but chemical wastes were still being disposed of at the site. He further described an excavation of some 30-40 feet deep in the landfill as penetrating the "35" foot water table with surface water runoff from the active disposal face of the landfill flowing to the deeper excavation; thence by seepage to the deeper sand pit to the west of the site (Ref. 18 Document 36).

In an Inter Office Memorandum of April 13, 1972, TWQB District 7 staff reported the site was receiving industrial trash and some industrial chemicals, primarily of a dry nature. According to TWQB District 7 staff and the operators of the site no municipal wastes were being received. They recommended the operators apply to the TWQB for a commercial industrial solid waste disposal Certificate of Registration for a Class II site (Ref. 18 Document 37).

In a May 8, 1972 letter the Texas Water Quality Board informed Mr. Bray that Wallace Waste Control's operation at the site was to be limited to the disposal of industrial trash since the City of Houston objected to using the site for disposal of garbage and municipal wastes. A TWQB inquiry determined the Texas Department of Health records indicated no record of a permit issued to any company of operations at the Almeda-Genoa Road at Minnesota Street site. In addition, TWQB stated their determination to have

Site: Mobile Waste Controls, Inc.
Date: 12/19/91

jurisdiction over the sites operations and Wallace Waste Control operators would be requested to submit an application for registration as a Class II industrial solid waste disposal site (Ref. 18 Document 38).

On June 8, 1972 Dr. Albert Randall, Director of Public Health, submitted to Mayor Welch a report stating the site was under City Health surveillance since approval to operate was issued on February 11, 1970. Receipt of garbage was not permitted, however, on occasions food products had been dumped as a part of the industrial and/or commercial trash at a rate of <5%. The report further stated the site had not been in full compliance with regulations, including odor problems due to the County Sheriff Department disturbing the landfill cover while searching for clothing of missing persons. Previous tests of Mr. Bray's well water indicated no bacteriological contamination (Ref. 18 Document 41).

On July 7, 1972 Dr. Randall wrote to Mr. R. Hausman, Realty Reclamation, Inc. notifying him of operational deficiencies encountered at the site through surveillance and complaints and the many verbal and written notices made to the landfill operation's management. This included fires on March 17 and 31, 1972 and June 29, 1972 and receipt of non-permitted wastes (Ref. 18 Document 42).

On July 1972 Mobile Waste Controls, Inc. submitted an application to operate a Class II industrial waste disposal facility to the City of Houston Public Health Department. The application proposed the expansion of operations from the Minnesota Street sand pit westward into the large sand pit along Easthaven Street. Proposed facility operational procedures and borings for the Easthaven Street pit were included in the application (Ref. 18 Document 43).

A review of Mobile Waste Control's application for a commercial solid waste disposal facility was completed by the City of Houston on February 2, 1973. In a letter to the Texas Department of Health, the City reported that their constant effort and pressure through two years of weekly or more frequent surveillance had alleviated operational problems at the site to only some degree. Further, the City reported that closer than weekly surveillance had recently been initiated. One of the more frequent problems cited was the continued acceptance of putrescible material at the site in spite of City demands to the contrary. The City formally objected to approval of the proposed application (Ref. 18 Document 43).

Included in the City of Houston letter of February 2, 1973 was a copy of the Mobile Waste Control's application and a report entitled: Subsurface Exploration, Hausman Sand Pit, Houston, Texas,

Site: Mobile Waste Controls, Inc.

Date: 12/19/91

prepared by Southwestern Laboratories. The report included results of four (4) borings made around the proposed new landfill (Figure 1 - Lake B). Results of B-2, from the northwest corner of the existing Mobile Waste landfill site (Figure 1 - Area A), found alternating lenses of clays and silty sands to the sample depth of 96 feet. The report stated hydrostatic water was encountered for all four borings at a depth of 8 to 12 feet below the existing ground level (Ref. 18 Document 43).

In a Texas Department of Health letter of March 28, 1973, the TDH notified Mobile Waste Controls, Inc. their application for operation of a commercial solid waste disposal facility had been denied (Ref. 18 Document 44).

In a City of Houston Field Investigation Report of May 26, 1982, City staff reported the results of a complaint investigation conducted at the Mobile Waste Minnesota Street site on May 25, 1982. The City observed several trenches and smaller holes had been made dug into the capped landfill (Ref. 18 Document 45). The City reported to the TDWR District 7 Office on May 27, 1982, they had found 10 large trenches through the landfill cover. City staff stated the leachate found in the trenches had strong odors of sulfide, methane gas, and some had vinyl chloride odors (Ref. 18 Document 48).

In a May 26, 1982 TDWR Telephone Memo, District 7 staff reported that Edna Woods Laboratory had collected samples of the closed landfill for a local developer. Edna Woods staff reported that sample results from another laboratory's earlier work indicated high lead and chromium in the landfill leachate (Ref. 18 Document 46).

In a telephone conversation of May 27, 1982 with TDWR District 7, Levering & Reid, Inc. reported the City had requested the trenches be closed with two feet of clay. In addition, the City advised that several core borings into the landfill would require closure by the soils engineering firm (Murrillo) that made them (Ref. 18 Document 49).

In a City of Houston Office visit of May 28, 1982, Ms. Buntin Moore and Ms. Anna Thompson, Levering & Reid, Inc., indicated the holes would be filled during the week of May 31, 1982 (Ref. 18 Document 50).

On June 3, 1982, City of Houston staff visited the site to observe the filling and covering of the trenches. The clay delivered to the site was too little to complete the job and additional material

Site: Mobile Waste Controls, Inc.
Date: 12/19/91

was requested. TDH Rosenberg staff were on-site conducting tests for methane gas of which low amounts were detected (Ref. 18 Document 51).

In a City of Houston Inter Office Correspondence of June 9, 1982, City staff were informed that an examination of the April 25, 1974 District Court injunction against Mobile Waste Controls, Inc. indicated it could not be enforced against the developers of Windmill Lakes Subdivision. The City was advised it would have authority to take action against Levering & Reid under the Texas Solid Waste Disposal Act, Article 4477-7 (Ref. 18 Document 53).

On June 17, 1982, City of Houston staff and Petro-Tex representatives visited the site to verify if the black tar-like waste found at the site came from Petro-Tex. Samples were collected by Petro-Tex (The sample results are not contained in the Mobile Preliminary Assessment). The City of Houston contacted Luberzoi Company who reported they had disposed of Class II industrial filter cake containing oil, additives and diatomaceous earth at the site when it was operated by Wallace Waste Control, Inc. (Ref. 18 Document 54).

In June and July, 1982, City of Houston staff contacted a number of local companies to determine if they had ever disposed of waste in the landfill. Diamond Shamrock, Goodyear Tire & Rubber Company, E.I. Du Pont De Nemours & Company, Houston Plant, and Rohm and Haas Texas Incorporated reported to the City of Houston finding no indication in their company records of ever having done business with any of the site's operators (Ref. 18 Documents 56, 57, 58 and 62).

On July 6 and 9, 1982 City of Houston staff contacted Mr. Buck Hausman and Mr. Ron Ramey, previous site operators, to request information on the industrial waste disposed at the site. They related the site was an old sand pit, approximately 3 ft. deep on the east, sloping to about 13 ft. deep on the west. They remembered no garbage being disposed, mainly paper and packaging materials (Ref. 18 Document 59).

In a Field Investigation Report of July 8, 1982, City of Houston staff reported the collection of water samples from the 3 lakes (Figure 1 - Lakes B, C, and D) and from ponded water found in two areas on the south boundary of the old landfill (Figure 1 - Area A). In addition, a leachate area found on the north side of the old landfill site (Figure 1 - Area A) was also sampled. City staff observed REI (Resource Engineering) staff on-site conducting

Site: Mobile Waste Controls, Inc.

Date: 12/19/91

resistivity tests. A monitoring well was identified near the southeast corner of the west lake (Figure 1 - Lake B) (Ref. 18 Document 60).

In a letter of July 29, 1982, U.S. Industrial Chemicals Company, reported to the City of Houston that in the latter part of 1971 they used Wallace Waste Control and a year or so later switched to Mobile Waste Controls. They stated no information was available in the company's records to indicate which disposal site was used (Ref. 18 Document 63).

A letter from Browning-Ferris Industries of August 6, 1982 reported to the City of Houston that during the period in question BFI used the Wallace Waste Control facility for the disposal of demolition material on a very limited basis (Ref. 18 Document 64).

On August 19, 1982 City of Houston staff observed heavy equipment at the site. In telephone conversations, Levering & Reid and REI stated that new plans had been submitted to the City whereby the developer will construct a only a road over the fill. City staff documented that the site preparation involved removal of 3 to 4 inches of landfill cover. Some waste was exposed, especially from the previously trenched areas. Fill dirt came from Sims Bayou modification project at Glenbrook Golf Course (Ref. 18 Document 65).

On August 24, 1982 work at the site was to be stopped and Levering & Reid were requested by City of Houston Public Health to develop a "site management plan" (Ref. 18 Document 67).

An August 25, 1982 inspection of the site by the City of Houston and Levering & Reid revealed the imported clay had been compacted over the landfill to approximately 1.5 ft. depth. Approximately 10-15 ft. of surface from the edge of the roadway was left uncovered. A small amount of waste was found exposed at the north and southwest property lines (Figure 1 - Area A). Construction had been halted (Ref. 18 Document 68).

On September 1, 1982, City Councilman Frank O. Mancuso contacted the City of Houston Public Health on behalf of Mrs. Betty Mitchell, 9805 Radio Road, to request a status report concerning conditions at the former landfill area. Mrs. Mitchell reported that 8 people in her area have cancer and fear the landfill has contributed to this finding (Ref. 18 Document 71).

In a City of Houston letter of September 3, 1982, Levering & Reid were provided a list of environmental safeguards to be met in order for the City to release its hold on the subdivision approval. The

Site: Mobile Waste Controls, Inc.

Date: 12/19/91

primary safeguards included requirements of no construction or excavation on the landfill area, except the planned road, and a 20 year ground water monitoring program (Ref. 18 Document 72).

On September 17, 1982 City of Houston Public Health staff collected samples from the 4 trenches, an area of ponded water in the center of the site, and the leachate area on the north property line (Figure 1 - Area A) (Ref. 18 Document 74)).

On September 22, 1982, REI provided the City of Houston a proposed landfill assessment program as the final version of Attachment A to the Levering & Reid letters of September 14 and 24, 1982. The proposal included monitoring for trace hydrocarbon contamination, along with general parameters of interest for closed municipal landfills. They reported five (5) ground water monitoring wells were installed around the closed landfill (Figure 1 - Area A) (Ref. 18 Document 75).

In a City of Houston letter of September 27, 1982, Judith Craven, Director of Public Health, City of Houston, notified the City's Public Works and City Planning Departments that there was no further objections to issuance of permits and planned construction at the site (Ref. 18 Document 79).

On October 28, 1982 City of Houston Public Health staff reported to Councilman Mancuso that samples taken within the landfill (Figure 1 - Area A) indicated low concentrations of contaminants of industrial origin. They reported samples from the lakes and various surface water accumulations in the area showed no significant amounts of any contaminants. City staff stated their presumption that none of the waste material was escaping the site by seepage or runoff. The report included the results for ph, heavy metals, BOD, COD and TOC samples collected at the site during May and July, 1982 (Ref. 18 Document 81).

In a TDWR Telephone Memo of April 14, 1983, City of Houston staff notified TDWR the Mobile Waste Controls landfill may be a potential candidate site for Superfund evaluation (Ref. 18 Document 82).

In a City of Houston Field Investigation Report of May 9, 1983, City staff reported all road work was complete with landscaping in progress. Exposed waste material was observed in several locations with a strong chemical odor present near exposed material on the west side of Windmill Lakes Blvd (Figure 1 - Area A west side). City staff observed ground water monitoring well #6 (Figure 1 - Area A west side) had a strong chemical odor (Ref. 18 Document 83).

Site: Mobile Waste Controls, Inc.

Date: 12/19/91

In a City of Houston Field Investigation Report of May 16, 1983, City staff reported results from the sampling of ground water monitoring wells nos. 1, 2, 5, and 6 was conducted. Monitoring wells nos. 3 and 4 had been plugged per an earlier agreement between the City and Levering & Reid. City staff observed a slight chemical odor was noted a well #5 and a strong chemical odor came from well #6. City of Houston sample results indicated high concentrations of Total Suspended Solids (TSS), Total Organic Carbon (TOC), Chemical Oxygen Demand (COD), and the presence of Benzene, Toluene and several other complex organic compounds in the monitoring wells (Ref. 18 Document 84).

The City of Houston Field Investigation Report of August 24, 1983 documented co-sampling of ground water monitoring wells nos. 1, 2, and 5. City staff reported an area of uncovered waste material was observed on the north side of the landfill (Figure 1 - Area A), including a styrene odor. The casing on well #5 had been damaged by construction crews. City of Houston sample results continued to indicate high concentrations of TSS, TOC, COD, Toluene, and several other complex organic compounds in the monitoring wells (Ref. 18 Document 85).

The City of Houston Field Investigation Report of November 15, 1983 documented the co-sampling of ground water monitoring wells nos. 1, 2, 5, and 6. City staff reported Well #6 had been destroyed when cover material was placed on the landfill area. The well was re-established at approximately the same spot. City of Houston sample results indicated high concentrations of TSS and several other complex organic compounds in the monitoring wells (Ref. 18 Document 86).

The City of Houston Field Investigation Report of February 16, 1984 documented the co-sampling of ground water monitoring wells nos. 1, 2, 5, and 6B. REI staff were observed conducting resistivity tests along the west lake (Figure 1 - Lake B). City staff observed several areas of ponded water were observed along the northern property line, around the fenced parking lot, and near well #6 (Figure 1 - Area A). Additionally, City staff reported the site (Figure 1 - Area A) had been seeded. City of Houston sample results indicated high concentrations of TSS, TOC, COD, and the presence of several other complex organic compounds in the monitoring wells (Ref. 18 Document 87).

In the Levering & Reid February 17, 1984 third quarterly landfill evaluation submitted to the City of Houston, the resistivity and ground water data indicated a slight increase in leachate movement in the vicinity of well nos. 2 and 5 (Figure 1 - Area A west side). The report indicated the leachate movement was due to an increased

Site: Mobile Waste Controls, Inc.

Date: 12/19/91

hydraulic gradient between the center of the landfill and the monitor wells from an increase of water elevation within the landfill. The report speculated the hydraulic gradient increase may have been due to rainfall infiltration from Hurricane Alicia which occurred prior to completion of the clay cap during October, 1983 (Ref. 18 Document 88).

In a City of Houston Field Investigation Report of May 14, 1984, City staff reported the grass at the site was dying due to lack of rain. City staff stated the northern property line (Figure 1 - Area A) still lacked 2 ft. of cover with waste material exposed along a long section. City staff observed all three new apartment complexes surrounding the site were occupied (Ref. 18 Document 90).

On October 24, 1991 TWC Superfund staff received information from staff of the City of Houston and TWC District 7 Office that a local resident and State Representative had made a citizen complaint regarding the site. The resident claimed a high incidence of cancer occurring in area residents with over half the residents of Radio Road having cancer. TWC District 7 staff reported initial sample results of <5 ppm TOC from the residents well located approximately 1 mile west of Lake B (Figure 1). Metal analyses had not been completed and no priority pollutant samples were taken from the well. District 7 staff reported recent inspections on the landfill area (Figure 1 - Area A) revealed strong petroleum/chemical odors especially following rain events. Chemical odors were detected at the bare surface areas on the west side of the site near the boat storage area (Ref. 18 Document 92).

III. Waste Containment/Hazardous Substance Identification

An unknown amount of industrial chemicals were disposed of at this former sand quarry from pre-1969 through 1974 (Ref. 18). Other wastes disposed at the site were wood, paper, plastics, rubber, metal, neoprene, styrofoam, urethane, PVC pellets, plastic resins, asbestos, oil contaminated filter cake, asphalt, and municipal garbage. Local residents reported it was not unusual for oil field and chemical plant wastes to have been dumped into pits in the area prior to 1969 (Ref. 18).

From May, 1983 to February, 1984, REI and the City of Houston Public Health Department co-sampled 4 of 6 ground water wells completed around the site. The 4 monitoring wells had a water elevation ranging from 30 to 45 feet above mean sea level. Two of the wells (#3 and #4) which bordered the south side of the site were plugged and not sampled. Concentrations of Total Suspended Solids (420 - 17,770 mg/l), Chemical Oxygen Demand (0 - 2,400

Site: Mobile Waste Controls, Inc.
Date: 12/19/91

mg/l), and Total Organic Carbon (64 - 313 mg/l) were found in the 4 monitoring wells (Ref. 18). The concentration ranges for identified contaminants of concern found in analyses of the landfill leachate (Well #6) and surrounding ground water (Wells #1, #2, and #5) were: Benzene (0.01 - 0.24 ug/l), Toluene (0.05 - 96.00 ug/l), Ethylbenzene (0.08 - 175.41 ug/l), 2-Nitropropane (0.19 ug/l), Chlorobenzene (3.53 ug/l), Cyclohexane (2.12 - 287.16 ug/l), Xylene (9.30 - 1,853.40 ug/l), Aniline (4,285.2 ug/l), Napthalene (0.10 - 24.10 ug/l), 1,4 Dichlorobenzene (7.10 ug/l), 1,1'-Diphenylhydrazine (943.9 ug/l), N-Nitrosodiphenyl Amine (1.00 - 126.6 ug/l), 2-Methyl phenol (191.00 ug/l), 2,4-Demethyl phenol (9.20 ug/l), 2,3-Dimethyl phenol (2.70 ug/l), Diethyl Phthalate (1.20 - 14.20 ug/l), and Styrene (831.8 ug/l).

The sand quarry covered approximately 25 acres and had been initially excavated to a depth of approximately 8 - 20 feet penetrating the shallow water table (Ref. 18; Attachments 7 and 8). Used as a landfill, by 1974 the area had been completely filled to an average thickness of 13 feet with the wastes described above. The pit was unlined and wastes were disposed directly into standing ground water. Accumulated water from the pit was pumped into the adjacent pit west of the site. In 1982, the integrity of the cap placed over the waste was disturbed by trenching and test boring to determine the site's suitability for residential development. Inspections of the site over the next 2 years often revealed areas of water accumulation and waste exposure over the fill area (Ref. 18; Attachments 7 and 8).

IV. Air Pathway Characteristics

There were no air samples taken at the site. No air contamination has been documented other than a history of fires reported from the site during its years of operations as a landfill. Waste disposal operations ceased at the site in 1974 due to issuance of a District Court permanent injunction requested by the City of Houston. November, 1991 TWC District 7 inspections on the landfill area reported strong petroleum/chemical odors emitting from bare soil areas along the western edge of the landfill area (Ref. 18 Document 92).

The air pathway for this site may be an active pathway.

Site: Mobile Waste Controls, Inc.

Date: 12/19/91

V. Ground Water Pathway Characteristics

Coastal Lowlands Aquifer System - Stratigraphic Units

The geologic formations from which the Houston district obtains its water supply are as follows, from oldest to youngest: sands in the Lagarto clay of Miocene (?) age, the Goliad sand of Pliocene age, the Willis sand of Pliocene (?) age, the Lissie Formation, and sands in the Beaumont clay of Pleistocene age. The formations crop out in belts parallel to the coast. The dip of the beds is toward the southeast at an angle steeper than the slope of the land surface, and the formations are leveled at their outcrop by the land surface. Likewise, each formation is encountered at progressively greater depths toward the southeast. The estimated dip of the older beds is 50-60 feet to the mile and of the younger beds about 20 feet to the mile (Ref. 2). The formations thicken considerably down dip. The rate of dip is variable owing to several salt dome structures within or adjoining the district. Some of the salt domes, such as Pierce Junction and Blue Ridge a few miles south of Houston, and Barber's Hill about 20 miles east of Houston, are remarkable structural features consisting of upthrusts of large masses of salt piercing the younger formations from a deep-seated source, the geologic position of which is unknown.

Owing to the mode of disposition, the formations are similar in lithology and origin and do not have persistent individual characteristics that can be traced downdip. Zones of predominantly sand and zones of predominantly clay were recognized in the Houston district. The sand zones consist of extremely irregular and lenticular beds of gravel, sand, silt, and clay. The clay zones are made up of mottled calcareous massive clays that contain numerous thin beds and lenses of fine to medium-grained sands. Interfingering layers and lenses of massive clays grade laterally and vertically into the sand zones, and sands and gravel likewise grade into the clay zones. The thinner beds change character or pinch out within a few hundred feet.

Although the beds of clay are in general poorly stratified and persist only short distances, a few of the zones of clay beds have been traced across the district by means of electrical logs. A study of the electrical logs used in these sections together with many other logs, however, suggests that even though the clay zones appear to persist across the district, none of the individual beds of clay within the zones between the Lagarto clay and the Beaumont clay extends very far. If this condition exists, the clay zones are not extensive confining units within the Goliad, Willis, and Lissie formations, which, therefore, may be considered a single

Site: Mobile Waste Controls, Inc.
Date: 12/19/91

aquifer. This is further suggested by the parallelism in fluctuations of artesian pressures in several observation wells, some of which are screened in the shallower sands and some in the deeper sands.

All the water pumped from wells in the Houston district comes from precipitation that enters the outcrops of the water-bearing sands northwest, north, and northeast of Houston. A large part of the rainfall on these areas is carried away by the streams, but a substantial part of it sinks into the soil, especially in sandy soil. During the late spring, summer, and early fall most of the water that enters the soil is lost by evaporation and transpiration. During the cool non-growing season, however, in large parts of these areas the water sinks downward through the permeable soil until less permeable underlying beds are encountered which slow the downward movement; and if the rainfall during this period is moderately heavy, a temporary shallow or perched water table is built up which frequently reaches nearly to the land surface. Later in the year a part of the soil moisture is lost by evaporation and transpiration, but a part of it percolates slowing downward to the permanent zone of saturation, the upper surface of which is the true water table. Thence the water moves laterally through the water-bearing beds into the artesian reservoir.

In the ground water reservoirs of the Houston District water percolates through interstices in the sand and the frictional losses may be relatively high even though the rate of movement is very slow, perhaps only a few hundred feet a year. All ground water reservoirs containing fresh water have natural outlets. Some of the outlets to the artesian reservoirs in the Gulf Coastal Plain in Texas are believed to be along the continental shelf out in the Gulf at comparatively great distances from the outcrops. Other outlets probably are within the clays, silts, and sands that overlie the main artesian reservoir, through which natural discharge may occur by slow upward percolation and diffusion.

Coastal Lowlands Aquifer System - Hydrogeologic Units

The Holocene-upper Pleistocene permeable zone is the uppermost hydrogeologic unit in the coastal lowlands aquifer system. It overlies the lower Pleistocene-upper Pliocene permeable zone, and its top is land surface onshore and sea bottom in the Gulf of Mexico. The unit consists of Holocene and upper Pleistocene sands and clays. Locally, the unit may include Holocene alluvial deposits (Ref. 4).

Since it is the surficial unit, the permeable zone has the largest outcrop area of all units in the Texas Gulf Coast aquifer systems.

Site: Mobile Waste Controls, Inc.

Date: 12/19/91

The outcrop area occupies the southern part of Harris County, the southern and eastern parts of Liberty County, and nearly all of Fort Bend, Brazoria, Galveston, and Chambers Counties. The basal 200 feet of the formation consists largely of sand, but the upper and middle parts are largely clay. This unit furnishes water to most of the large producing wells at Baytown, Texas City, and Alta Loma and to shallow wells in Houston (Ref. 3).

The altitude of the top of the unit ranges from about 350 feet above sea level in the west to more than 1000 feet below sea level in downdip areas in the Gulf. Thickness of the unit ranges from 0 at the updip limit to more than 900 feet offshore in the east (Ref. 4).

Coastal Lowlands Aquifer System - Aquifer Units

The structure and stratigraphy of the Houston District is very complex and the delineation of the aquifers is extremely difficult. Much emphasis has been placed on the ground water hydraulics in order to properly define this ground water system. The result is a ground water system divided into two major aquifers, the Chicot and Evangeline, which are underlain by the Burkeville confining layer that is composed principally of clay (Ref. 5).

The Evangeline aquifer is the major source of ground water in the Houston district, but in Galveston County and southern Harris County, the Chicot aquifer is the major source of ground water because in these areas the Evangeline contains saline water (Ref. 5).

The Alta Loma Sand is the basal sand of the Chicot aquifer in some parts of the district. The Alta Loma Sand is the primarily source of water in the Chicot aquifer except in the Texas City area. At Texas City, sand and gravel lenses in the middle part of the Chicot are the important sources of water, and the Alta Loma Sand contains highly mineralized water (Ref. 5).

Site Hydrogeologic Characteristics

The Mobile Waste Controls site was originally part of a sand-quarrying operation that ceased operations in late 1967 or early 1968 with the enforcement of a 1964 City of Houston Ordinance that prohibited the pumping of groundwater from the pits into ditches beside public streets. The sand pits were excavated in the Beaumont Formation of Pleistocene age. The upper 100 feet of the Beaumont at the site is comprised of lintels of red, tan, and light grey sand, silty and clayey sand, sandy clay, and clay. These sediments dip to the southeast at about 15 to 20 feet per

Site: Mobile Waste Controls, Inc.
Date: 12/19/91

mile. The shallow ground water above a subsurface depth of 100 feet at the site exists under water table conditions except where confined by clay lenses. Recharge to the formation is by precipitation on the outcrop of sandy sediments (Ref. 4).

Many privately owned wells near the site produce water for domestic supply from depths of 100 feet or less. Deeper wells in the general area of the landfill site produce water for public supply. These wells are completed in sands of the Lower Chicot at depths of 600 to 1000 feet.

Two separate references in the records for this site report the movement of ground water from the landfill to an adjacent pit west of the site (Ref. 18). This ground water movement is counter to the general southeastern groundwater movement for the Houston district.

The Mobile Waste Controls site lies within a wellhead protection area (Ref. 12).

VI. Surface Water Pathway Characteristics

The coastal plain between the San Jacinto River and the Brazos River forms the San Jacinto-Brazos Coastal Basin. Most of the basin's segments are small tidal streams which drain into Galveston Bay. Total basin drainage area is 1,440 square miles. The average discharge for Clear Creek is 36.1 cubic ft./s or 26,150 acre ft/yr (Ref. 14).

The site is in the drainage area of Clear Creek above tidal segment (1102) of the San Jacinto-Brazos Coastal Basin (Ref. 7) and is located in an area of >500 year Floodplain (Ref. 9). It is classified "water quality limited" with a known water quality problem that the segment does not meet swimmable criteria due to frequently elevated levels of fecal coliform bacteria and dissolved oxygen levels occasionally below 5.0 mg/l. Potential water quality problems for the segment are: 1) supersaturated dissolved oxygen levels occur occasionally; 2) chlorides, total dissolved solids and fecal coliform are rarely elevated; 3) inorganic nitrogen is frequently elevated; 4) total and orthophosphorus are persistently elevated.

Surface drainage from the site flows south and southeast into a small lake formed from an excavated sand pit which borders the southern edge of the site. From the site it is approximately <0.25

Site: Mobile Waste Controls, Inc.

Date: 12/19/91

mile to a Harris County Water Control and Improvement District (WCID) drainage ditch; thence approximately 5 miles downstream to its confluence with Clear Creek above tidal (Ref. 15).

Intensive surveys were conducted on Clear Creek in September, 1976 (Ref. 7) and September, 1979 (Ref. 8). Water Quality conditions were monitored on the WCID drainage ditch discharge (Reference MudGully) at Choate Road (>4 miles downstream from the Mobile Waste Controls site) during both studies. From 1969 through 1976, there were documented releases of styrene tars, sodium sulfide, cresylic acid, cumene, and ethyl benzene into the drainage ditch downstream this monitoring station. The releases came from an industrial facility one-half mile upstream from the Clear Creek confluence. Releases were not documented above the Choate Road station.

The TWC conducts routine water analysis at the following downstream ambient surface water quality monitoring stations in this segment of Clear Creek.

1102.0050 - Clear Creek at Friendswood Link Road at Friendswood, (29 31 30 / 095 11 00); and

1102.0100 - Clear Creek at FM 2351 at Webster west of Friendswood, (29 32 31 / 095 11 48)

VII. On-Site Pathway Characteristics

The on-site pathway is active. The site exhibits free access on all sides. It is a maintained grass field transected by Windmill Lakes Blvd. with a boat storage area located on the western edge of the site (Attachment 5). The site is bordered by a horse stable to the east, an undeveloped area to the north, Windmill Lakes Apartments to the south, and a large lake to the west. Although capped, there are areas of bare soil on-site which emit strong petroleum/chemical odors (Ref. 18).

A. Ground Water Targets

Private, industrial, irrigation, and municipal wells are located within a one mile radius of the site. Two of three municipal wells have been plugged. The private wells had depths to water ranging from 90 ft. - 425 ft. (Ref. 11). Static water levels in these wells ranged from 6 ft. - 200 ft. Most of the wells were completed in the upper portion of the Chicot Aquifer.

Site: Mobile Waste Controls, Inc.

Date: 12/19/91

Within 0 - 0.25 miles of the site there are 0 municipal wells, 3 private wells, 0 industrial wells, and 1 irrigation well. The private wells nearest the site appears to be Platted Well No. 65-31-1E owned by C.A. Collins, Platted Well No. 65-31-1E (Dup) owned by W.J. Bell, and Platted Well No. 65-31-1B owned by Jack Allen. Platted Well No. 65-31-1 (irrigation well) owned by Windmill Landing Apartments is nearest to the site.

Between 0.25 - 0.50 miles of the site there are 0 municipal wells, 1 private well, and 0 industrial wells.

Between 0.5 - 1 mile of the site there is 1 municipal well, 15 private wells, and 4 industrial wells. Harris-Galveston Coastal Subsidence District Well No. 1202 owned by Houston Lighting & Power (South Houston Substation) is the nearest municipal well to the site. This well provides water to HL&P employees.

Between 1 - 4 miles of this site there are numerous private, industrial, and municipal wells. Three (3), four (4), and four (4) municipal wells are located in the 1 - 2 mile, 2 - 3 mile, and 3 - 4 mile radii, respectively. All municipal wells and their calculated populations served are documented in Attachment 2.

All available well logs within the 1 mile radius of the site are included as Attachment 2.

B. Surface Water Targets

Surface water drainage from the site flows southwest and west into two adjoining lakes/ponds. Surface water drainage may also occur southwestward along Windmill Lakes Blvd. between the two lakes to a Harris County Water Control and Improvement District drainage ditch and thence to Clear Creek (Ref. 15).

Surface Water Use Permit No. 005183, Harris County (Precinct One), exists approximately 15 miles downstream from the site. This permit is for recreational (non-consumptive) use and provides for the diversion of up to 12 acre feet per year to a reservoir (Ref. 10). No surface water use permits for drinking water are in existence within the 15 mile target distance limit downstream from the site (Ref. 10).

The Windmill Lakes provide a fishery habitat. Local residents routinely fish each of the three lakes (Ref. 18).

Land and water habitats for threatened and endangered species exist within a 4 mile radius and 15 miles downstream from the site (Refs.

Site: Mobile Waste Controls, Inc.
Date: 12/19/91

13 and 15). The Windmill Lakes surrounding the Mobile Waste Controls site may provide habitat to the Houston Toad (Bufo houstonensis). Other Federal and State rare or threatened and endangered species which can exist within the local woodlands and prairie vegetation are the Attwater's Greater Prairie-chicken (Tympanuchus cupido attwateri); the Smooth Green Snake (Opheodrys vernalis); the Texas windmill-grass (Chloris texensis); the Houston machaeranthera (Machaeranthera aurea); and the Crawfish Frog (Rana areolata).

C. Soil Exposure Targets

The Windmill Landing (259 Units), The Point (160 Units), and The Cove (392 Units) apartments were constructed adjacent to the site and among Windmill Lakes (Preliminary Assessment Site Sketch; Attachment 5 Telephone Memorandum and Photographs 1-11). The approximate total population of the three apartments is 1,946 residents. An estimated 299 total units from the three apartment complexes are within 200 ft. of the site (Attachment 5 Telephone Photographs 1-11). In addition, Windmill Blvd. and a boat storage facility is located on-site. No schools or day care facilities were identified within 200 ft. of the site. Surface exposed wastes and stressed vegetation have been documented at the site (Refs. 18 and Attachment 5 Photographs 1, 3, 5, and 9-11).

D. Air Targets

The air pathway is active. There have been reported releases of strong petroleum/chemical odors emitting from bare soil areas observed at the site (Ref. 18 Document 92). There are 811 apartment units, containing approximately 1,946 residents, located adjacent to the site (Attachment 5). Access to these apartments is on Windmill Blvd. which was constructed over the site (Ref. 18 Document 45; Attachment 5 Photographs 1-2, 6-7, and 10-11). In addition, a boat storage facility is located on-site (Attachment 5 Photographs 9-11). An estimated 50,000 residents live within a 4 mile radius from the site (Preliminary Assessment Air Target Populations).

Site: Mobile Waste Controls, Inc.
Date: 12/19/91

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1. Guidance for Performing Preliminary Assessments Under CERCLA, Hazardous Site Evaluation Division, U.S. Environmental Protection Agency, Publication 9345.0-01A, September, 1991.
2. Texas State Board of Water Resources, Bulletin 5001, "Geology and Ground-Water Resources of the Houston District, Texas", October, 1950.
3. Texas Board of Water Engineers, "Ground-Water Resources of the Houston-Galveston Area and Adjacent Region, Texas", 1939.
4. U.S. Geological Survey, Water-Resources Investigations Report 87-4248, "Hydrogeology and Predevelopment Flow in the Texas Gulf Coast Aquifer Systems, 1988.
5. Texas Department of Water Resources, Report 241, "Development of Ground Water in the Houston District, Texas, 1970-74", January, 1980.
6. Texas Water Commission, LP 90-06, "The State of Texas Water Quality Inventory", 10th Edition 1990.
7. Intensive Surface Water Monitoring Survey For Segments 1101 and 1102 - Clear Creek - Tidal and Above Tidal, Report No. IMS 62, Texas Department of Water Resources, September, 1977.
8. Intensive Survey of Clear Creek and Clear Creek Tidal Segments Nos. 1102 and 1101, Report No. IS 5, Texas Department of Water Resources, January, 1980.
9. Texas Water Commission, Water Rights and Uses Division, Dam and Floodplain Safety Section, Flood Management Unit, Floodplain Maps.
10. Texas Water Commission, Water Rights and Uses Division, Surface Water Section, Surface Water Use Maps for Harris County.
11. State of Texas Water Well Logs (located and platted), Harris and Brazoria Counties, within 1 mile radius of site and for municipal wells up to 4 miles from the site. Including Telephone Memoranda, Harris-Galveston Coastal Subsidence District, and ground water target population calculations (Attachment 2).
12. Texas Water Commission, Water Rights and Uses Division, Ground Water Conservation Unit, Wellhead Protection Area (WHPA) maps.

Site: Mobile Waste Controls, Inc.
Date: 12/19/91

References

13. Letter of June 20, 1991 from Ms. Dorinda Sullivan, Data Manager, Texas Natural Heritage Program, Texas Parks and Wildlife Department, Texas Natural Heritage Program, Resource Protection Division, to Mr. Allan M. Seils, Pre-Remedial Unit, Superfund and Emergency Response Section, TWC Hazardous and Solid Waste Division (Attachment 3).
14. Water Resources Data, Texas Water Year 1990, Volume 2, U.S. Geological Survey Water-Data Report TX-90-2.
15. U.S. Geological Survey Topographic Maps: Pearland, Texas; Park Place, Texas; Friendswood, Texas; and Pasadena, Texas, 1982.
17. 1990-1991 Texas Almanac and State Industrial Guide, Copyright 1989, A.H. Belo Corp. P.O. Box 655237, Communications Center, Dallas, Tx. 75265, Published by the Dallas Morning News.
18. Letters, Telephone Memoranda, Interoffice Memoranda, and Conference Records from January, 1970 to November, 1991 (Attachment 4).

Site: Mobile Waste Controls, Inc.

Date: 12/19/91

Attachments

1. Public Law 94-171 Redistricting Data from the 1990 Census; Texas Natural Resources Information System.
2. State of Texas Water Well Logs (located and platted), Brazoria County. Including Telephone Memoranda, Harris-Galveston Coastal Subsidence District, and ground water target population calculations.
3. Letter of June, 1991 from Texas Parks and Wildlife related to endangered/threatened species of Harris County.
4. Letters, Telephone Memoranda, Interoffice Memoranda, and Conference Records from January, 1970 to November, 1991.
5. Notes and photographs (1-11) from TWC site visit made by Stennie Meadours on April 29, 1991 and with Allan Seils on October 9, 1991. Telephone Memo to the File of October 24, 1991 containing conversations with three apartment complex employees.
6. Copy of Aerial Photograph, 10/31/1962, 2-64, GS-VANT, RSDIS#000902, Harris County and an Aerial Photography Summary Record System printout from the Texas Natural Resource Information System.
7. Resource Engineering (REI), "Windmill Lakes Closed Municipal Landfill Site Evaluation and Development Strategy", Prepared for Levering and Reid, Inc., March, 1983.
8. Resource Engineering (REI), "Windmill Lakes Final Landfill Closure and Initial Monitoring", Prepared for Levering and Reid, Inc., October, 1983.

Appendix B

Health and Safety Plan

Health and Safety Plan

for

Mobile Waste Controls

TXD 980051652

Houston, Texas

Prepared in cooperation with

Texas Water Commission

and

U.S. Environmental Protection Agency

October 1992

Health and Safety Plan

**Mobile Waste Controls
Houston, Texas**

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The preparation of this report was financed through grants from the U.S. Environmental Protection Agency through the Texas Water Commission

**HEALTH AND SAFETY PLAN
FOR
TEXAS WATER COMMISSION
SCREENING SITE INSPECTION FIELD WORK
MOBILE WASTE CONTROLS**

Prepared by

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Reviewed and approved by

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10/9/92
Date

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10/9/92
Date

October 1992

CONTENTS

	<u>Page</u>
Section 1: Introduction	1
Purpose and Policy.....	1
Program Description	1
Section 2: Site Information	2
General Information.....	2
Scope of Work Summary	2
Site/Chemical Characteristics	3
Section 3: Project Team Organization	5
Section 4: Safety and Health Risk Analysis.....	8
Respiratory Hazards.....	8
Chemical Hazards.....	8
Routes of Exposure.....	8
Physical Hazards	9
Inactive Sites.....	9
Heat Stress.....	9
Noise.....	10
Snake Hazards.....	10
Safe Work Practices.....	10
Boat Safety.....	14
Section 5: Personnel Protection Equipment and Monitoring	15
Respiratory Protection	15
Dermal Protection	15
Medical Surveillance	15
Site-Specific Training	16
Section 6: Accident Prevention and Contingency Plan	17
Accident Prevention	17
Buddy System	17
Contingency Plan.....	17
Emergency Procedures	17

Contents, continued

	<u>Page</u>
Chemical Exposure.....	18
Personal Injury	18
Evacuation Procedures	18
Section 7: Frequency and Types of Air Monitoring.....	19
Air Monitoring Equipment Calibration and Maintenance	19
HNu Photoionization Detector	19
Foxboro Century Organic Vapor Analyzer Model 128.....	22
Monitoring Requirements and Instrument Limitations	23
Section 8: Site-Specific Decontamination Procedures	24
Personnel Decontamination Procedures.....	24
Emergency Contacts.....	iv
Appendix A: Plan Acceptance Form, Accident Report, and Job Safety & Health Protection Notice	
Appendix B: MSDSs	

FIGURES

4.1	Heat Exhaustion/Heat Cramps.....	12
4.2	Heatstroke.....	13

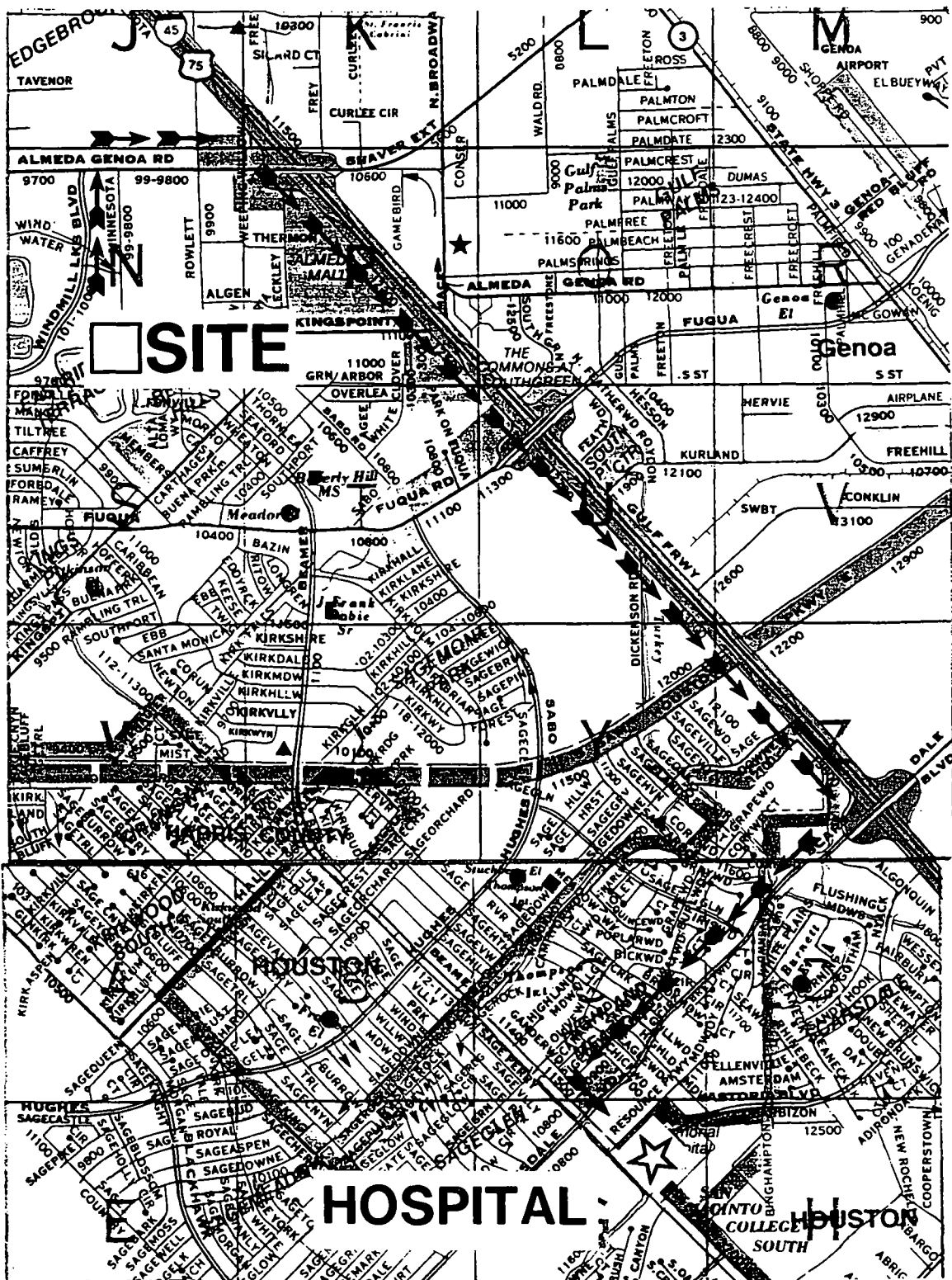
TABLES

3.1	On-site Personnel.....	6
4.1	Suggested Frequency of Physiological Monitoring for Fit and Acclimatized Workers.....	11
7.1	Chemicals of Record at the Mobile Waste Controls Site.....	20
7.2	Chemicals of Record for Field Investigations	21

EMERGENCY CONTACTS

In the event of any situation or unplanned occurrence requiring assistance, the appropriate contact(s) should be made from the list below. For emergency situations contact the appropriate response teams.

Contingency Contacts		Phone Number
Fire Department		911
Police		911
Sheriff's Department		911
Medical Emergency		
Hospital Name		Memorial Southeast
Hospital Phone No.		(713) 929-6100
Hospital Address		11800 Astoria Houston, Texas
Map to Hospital (see next page)		
Ambulance Service		1-800-592-4741
ES Contacts		
ES Project Manager:		Brian Vanderglas – Austin, Texas Telephone: Work (512) 467-6200
ES Office Health & Safety Representative:		Krista Walker – Houston, Texas Telephone: Work (713) 943-5432
Corporate Health & Safety Manager:		Ed Grunwald – Atlanta, Georgia Telephone: Work (404) 325-0770
TWC Contacts		
Central Office: Allen Seils		Telephone: (512) 908-2514
District Office:		Telephone: (713) 457-5191



Take I-45 south until the Scarsdale exit. Go west. Turn left on Beamer.

SECTION 1

INTRODUCTION

PURPOSE AND POLICY

The purpose of this health and safety plan is to establish personnel protection standards and mandatory safety practices and procedures for work conducted for screening site inspections (SSI) under the Texas Water Commission Preliminary Assessment/Site Investigation (PA/SI) program. The plan assigns responsibilities, establishes standard operating procedures, and provides for contingencies that may arise while field work is being conducted at the Mobile Waste Controls site in Houston, Texas.

All personnel who engage in field project activities at the site must be familiar with this plan and comply with its requirements. The provisions of the plan are mandatory for all ES field personnel on this project.

PROGRAM DESCRIPTION

This screening site inspections will be conducted in conformance with the requirements of the revised Hazard Ranking System (HRS) 40 CFR Part 300; Final Rule, dated December 14, 1990. ES recently completed collecting information needed to prepare a work plan and this health and safety plan. ES personnel will visit the site to execute the work plan and conduct inspection activities. Activities that will be conducted during the site visit include site reconnaissance, interviews with any site personnel, and collection of soil, sediment, and groundwater samples. The anticipated time frame for the execution of all the field work is from June to December 1992. This health and safety plan pertains to activities performed while executing the work plan.

SECTION 2

SITE INFORMATION

GENERAL INFORMATION

Site: Mobile Waste Controls TXD 988 051 652

Location: 10000 Minneosa St., Houston, Texas 77034

Proposed date of field work: October 12 - 14, 1992

Hazard Assessment: ☐ High ☐ Medium ☒ Low
 ☐ None ☐ Unknown

Site description: Mobile Waste Controls was operated as an industrial and commercial landfill from 1969 through 1981. The 25-acre site is a maintained grass field (landfill cover) transected by Windmill Lakes Boulevard with a fenced boat storage facility constructed on top of the landfill cover. The site is surrounded by apartment complexes, four lakes, and a vacant lot and horse stable. An unknown quantity of industrial chemicals were disposed at the site. In addition, wood, paper, plastics, rubber, metal, neoprene, Styrofoam, urethane, PVC pellets, plastic resins, asbestos, oil-contaminated filter cake, asphalt, and municipal garbage were also disposed at the site.

SCOPE OF WORK SUMMARY

The field team will collect groundwater, soil, sediment, and surface water samples. Five groundwater samples (including one duplicate) from four domestic, private, water-supply wells located off-site will be collected. In addition, four on-site monitoring wells will be sampled. A total of nine groundwater samples will, therefore, be collected. The groundwater samples from the domestic water wells will be collected from a point as close to the well as possible, and before the water is processed through any treatment devices. The monitoring wells to be sampled will be checked for the presence of separate-phase hydrocarbons with an interface probe prior to sampling. Based on well depths and water level measurements, the appropriate well purge volume will be determined for each well to be sampled. Wells will be sampled with bailers that have been decontaminated prior to use. The owner's contractor, Southwest Laboratories, will perform well purging activities.

Three surface water lake samples will be collected from Lake Westwind, Bass Lake, and Windmill Lake. One duplicate surface water sample will also be

collected. The surface water samples will be collected with approved pond sampling equipment using approved surface water collection techniques.

Four sediment samples, including one duplicate sediment sample, will be collected at the probable point of entry into Lake Westwind, Bass Lake, and Windmill Lake along the groundwater to surface water pathway. The sediment samples will, therefore, be obtained from below the water line. The sediment samples will be collected according to the procedures outlined in the *Water Quality Monitoring Procedures Manual* published by the Texas Water Commission.

Six soil samples, including one background and one duplicate soil sample, will be collected during field activities. The six soil samples will be collected in the vicinity of stressed vegetation, stained soil, or adjacent to MW-2 to assess the potential for soil contamination related to leachate migration or contaminant exposure. The soil samples collected will be procured from the upper 6 inches of the soil column using trowels, shovels, and/or hand augers.

SITE/CHEMICAL CHARACTERISTICS

Chemical
type(s): X Liquid X Solid X Sludge Gas

Characteristic(s): Corrosive X Ignitable Radioactive
 X Volatile X Toxic Reactive
 X Unknown Other (Name) _____

Summary of known wastes: See below.

List of chemicals used on site: None known.

Description of all known waste disposal areas on site: One 25-acre waste disposal area. During the late 1960s, the area was an active sand quarry. Five deep pits were excavated at the site; two large (1,000-foot diameter) and three small (300-foot diameter). Precipitation, surface water runoff, and groundwater accumulation caused the two large and two of the small pits to become four small lakes. The fifth pit (the site under investigation) was used for disposal of wastes. From 1969 through 1981, the property was owned by Realth Reclamation, Inc., and operated as an industrial and commercial landfill by Wallace Waste Control Company, Metropolitan Waste Conversion, National Disposal Contractors, and Mobile Waste Controls, Inc.

By 1972, the small, unlined pit used for disposal of waste had been two-thirds filled with industrial and commercial wastes. City of Houston representatives documented receipt of industrial chemicals and municipal and putrescible wastes; several fires; and odor problems. An unknown quantity of industrial chemicals were disposed in this pit for at least 5 years, ending in 1974. In addition, wood, paper, plastics, rubber, metal, neoprene, Styrofoam, urethane, PVC pellets, plastic resins, asbestos, oil-contaminated filter cake, asphalt, and municipal garbage have been disposed at the site. The total volume and precise composition of the waste disposed at the site is not known.

Resource Engineering, Inc. (REI) (hired by Levering & Reid), and the city of Houston Public Health Department conducted joint groundwater sampling at the site during 1982, 1983, and 1984. Groundwater sample results indicated excess concentrations of total suspended solids (TSS) and total organic carbon (TOC); high chemical oxygen demand (COD); and the presence of benzene, toluene, and several complex organic compounds in the monitoring wells sampled. In 1983, detectable levels of extractable priority pollutants were present in the leachate samples collected from the landfill; however, the leachate was not determined to be hazardous according to Resource Conservation and Recovery Act (RCRA) standards. Ten aliphatic hydrocarbons (oil constituents and/or stable organic decomposition products); 14 fatty acids; and 11 RCRA-listed organic compounds (toluene, xylene, aniline, naphthalene, 1,4-dichlorobenzene, 1,1'-diphenylhydrazine, N-nitrosodiphenyl amine, 2-methyl phenol, 2,4-dimethyl phenol, 2,3-dimethyl phenol, and diethyl phthalate) were also detected in the leachate.

Based on this characterization of the site, the primary contaminants of concern are benzene, toluene, ethylbenzene, 2-nitropropane, chlorobenzene, cyclohexane, xylene, aniline, naphthalene, 1,4-dichlorobenzene, 1,1'-diphenylhydrazine, N-nitrosodiphenyl amine, 2-methyl phenol, 2,4-dimethyl phenol, 2,3-dimethyl phenol, diethyl phthalate, and styrene. Additionally, accumulation of methane in adjacent structures presents a potential health and safety concern.

Summary of offsite disposal: None known.

Unusual features (dike integrity, power lines, terrain, etc.): Utility easement - power lines. Spring-fed lakes.

Current status of the site: Inactive.

Summary of the regulatory history of the site (worker or nonworker injury, complaints from public, previous remedial or enforcement action): In July of 1972, the operators, owners, and Mobile Waste Controls, Inc., the then operator, submitted a permit request to the city of Houston Health Department to convert one of the larger lakes to a disposal site. It is reported in a letter to the mayor and council that the landfill, "was closed in 1974 under permanent injunction which resulted from court action by the City Health Department." Evidence indicated that the operator was accepting various industrial wastes in violation of the permit. The correspondence between the owner, the city health department, and the consultant in the fall of 1982 show that a continuing program of long-term monitoring of groundwater was to be made. Samples were to be taken quarterly for two years, and biannually thereafter for 20 years. However, there are no sample results for any tests after that period.

A complaint was received by the city during 1982 and again in 1992 from a Mrs. Betty Mitchell of 9805 Radio Road. She requested that the water around the site be tested. She further commented about a number of cancer cases found in the area. The request, submitted in 1982, was answered by John Moore of the Health Department on October 28, 1982. An investigation is also currently being made concerning the complaint received in 1992.

SECTION 3

PROJECT TEAM ORGANIZATION

Table 3.1 describes the responsibilities of all on-site personnel associated with this project. The names of principal on-site personnel associated with this project are listed below:

ES Project Manager:	Brian Vanderglas
Site Safety Officer:	Dan Kelmar
Site Investigation Manager:	Brian Vanderglas
Assistant:	Kelly Krenz

Table 3.1 On-site Personnel

Title	General Description	Responsibilities
Project manager/ deputy	Reports to upper-level management. Has authority to direct response operations. Assumes total control over site activities.	<p>Prepares and organizes the background review of the situation, the work plan, the project health and safety plan, and the field team.</p> <p>Briefs the field team members on their specific assignments.</p> <p>Ensures, through the site safety officer, that safety and health requirements are met.</p> <p>Serves as the liaison with the client.</p>
Site safety officer	Advises the project manager on all aspects of health and safety on site. Stops work if any operation threatens worker or public health or safety.	<p>Periodically inspects protective clothing and equipment.</p> <p>Ensures that protective clothing and equipment are properly stored and maintained.</p> <p>Ensures entry and exit controls at access control points.</p> <p>Confirms each team member's suitability for work based on a physician's recommendation.</p> <p>Monitors the work parties for signs of stress, such as cold exposure, heat stress, and fatigue.</p> <p>Implements the health and safety plan.</p> <p>Conducts periodic inspections to determine if the project health and safety plan is being followed.</p> <p>Enforces the buddy system.</p> <p>Knows emergency procedures; evacuation routes; and the telephone numbers of the ambulance, local hospital, poison control center, fire department, and police department.</p> <p>Notifies, when necessary, local public emergency officials in coordination with on-site representatives.</p> <p>Coordinates emergency medical care.</p> <p>Ensures setup of decontamination lines and solutions appropriate for the type of chemical contamination on site.</p> <p>Controls decontamination of all equipment, personnel, and samples from the contaminated areas.</p> <p>Ensures proper disposal of contaminated clothing and materials.</p> <p>Ensures that all required equipment is available.</p> <p>Advises medical personnel of potential exposures and consequences.</p> <p>Notifies emergency response personnel by telephone or radio in the event of an emergency.</p> <p>Ensures that all personnel are capable of appropriately using the equipment.</p>

Table 3.1, continued

Title	General Description	Responsibilities
Site investigation manager	Responsible for field team operations.	<p>Obtains permission for site access and coordinates activities with appropriate officials.</p> <p>Ensures that the work plan is complete and on schedule.</p> <p>Manages field operations.</p> <p>Executes the work plan, schedule, and health and safety plan.</p> <p>Enforces safety procedures.</p> <p>Documents field activities and sample collection.</p> <p>Serves as a liaison with the on-site client representative.</p> <p>Prepares the final report and support files on the response activities.</p>
Field team members	Perform field activities as instructed by site investigation manager.	<p>Safely complete the on-site tasks required to fulfill the work plan.</p> <p>Notify project health and safety officer or supervisor of suspected unsafe conditions.</p> <p>Take precautions necessary to prevent injury to themselves and other employees.</p> <p>Comply with project health and safety plan.</p> <p>Maintain visual contact between partners (buddy system).</p> <p>Perform only those tasks they believe they can do safely.</p> <p>Immediately report to the field team leader any accidents and/or unsafe conditions, or any deviations from this plan.</p>

SECTION 4

SAFETY AND HEALTH RISK ANALYSIS

RESPIRATORY HAZARDS

Respiratory hazards may exist on site from the potential presence of volatile organics and priority pollutants in the soil, which could be inhaled if dust were produced during soil sample collection. An unknown volume of industrial chemicals were disposed on site.

CHEMICAL HAZARDS

Chemical hazards to the field team can exist when liquid, vapors, or soil samples contact human tissue. Every effort will be made to avoid contact with the chemical media at the site. Soil, groundwater, sediment, and surface water samples will be collected at the site. Chemical hazards during sampling are the potential presence of landfill leachate containing hazardous substances, volatile organics, and/or priority pollutant metals detected during previous investigations.

Information on the contaminants that may be encountered at the site is presented in Section 2 and Appendix B. Although not expected, the site may contain solvents or other chemicals that may release hazardous or toxic vapors. The site will be approached with caution, and any moving or handling of drums, containers, or equipment will be avoided.

Other chemical hazards which may be encountered at the site are airborne particulates (i.e., pesticides, semivolatiles, and metals). If a site is suspected of containing pesticides, semivolatiles, or metals, it will be approached with caution. Since particulates are of concern at these sites, high winds and industrial activities which create dust can cause these particulates to become airborne, therefore creating a respiratory hazard. If these conditions occur at the site, work will be conducted upwind of the hazard or the site will be evacuated.

ROUTES OF EXPOSURE

The field team may be exposed to contaminated materials through inhalation, ingestion, and skin and eye contact.

- Respiratory system contact with hazardous airborne materials can occur due to lack of or improper use of respiratory equipment.

- Eye contact with solid samples that are contaminated can occur when a worker does not wear safety glasses around places where samples are being taken or handled.
- Skin contact with solid or liquid samples that are contaminated can occur when a worker does not wear protective clothing around sampling activities.
- Gastrointestinal system contact with samples can occur when workers do not pay attention to personal hygiene rules designed to reduce the chance of ingesting site contaminants (hand washing before smoking, eating, or drinking).

PHYSICAL HAZARDS

Inactive Sites

This site is no longer active. This site possesses an additional hazard in that the conditions at the site are not well known and may have deteriorated. Field work will be performed using extreme caution.

- Entry into any structures should be avoided.
- Entry into any confined space is prohibited.
- Structures such as stairs, ladders, and catwalks should be avoided.
- Moving or opening any containers, drums, bags, etc., will be avoided.
- The "buddy" system will be used at all times.

Heat Stress

If elevated temperatures are encountered, heat stress may occur. Field work may be performed during the summer when daytime temperatures are often high. Water will be available on site, and the site safety officer will encourage workers to drink frequently to prevent dehydration and stay in shaded areas whenever possible. In addition, workers should adhere to a work/rest schedule determined by the site safety officer and dependent on work levels and outside temperatures to keep the body temperature in a normal range.

Heat stress/stroke control. The ES site safety officer will set work and break schedules, depending on the outside temperature. General guidelines for heat stress control while sampling include rest breaks in the shade for at least 10 minutes out of every hour during elevated temperatures. Rest time shall also include fluid replacement with water or electrolytes (i.e., Gatorade or equivalent).

Heat stress/stroke monitoring. The ES site safety officer will monitor workers who are performing strenuous activities in elevated temperatures for heat stress/stroke. Monitoring will be conducted at the officers discretion, workers request, and/or early in the rest period. The monitoring shall also be conducted when workers performance or mental status changes. The heat stress monitoring plan may include:

- Measurement of worker heart rate, OR

- Measurement of body temperature
- Observation of the field team for signs and symptoms of heat injury.

Heart rate (HR) will be measured by the radial pulse for 30 seconds as early as possible during the resting period. The HR at the beginning of the rest period should not exceed 100 beats per minute. If the HR exceeds 100 beats per minute, the next work period will be shortened by one third while the length of the rest period remains the same.

Body temperature will be measured using a "fever detector" strip that is placed on the forehead of worker or an oral thermometer. Worker body temperature should not exceed 99.6°F. If the worker's body temperature exceeds this, the work period will be shortened by one third while the length of the rest period remains the same. No person will be permitted to wear a semipermeable or impermeable garment when body temperature exceeds 100.6°F.

Table 4.1 also defines suggested frequency for heat monitoring. Heat stress monitoring will be performed by a person with a current first-aid certification. Workers that exhibit signs of heat injury will be allowed to rest until the signs are no longer observable. The signs of heat stress/stroke are depicted in Figures 4.1 and 4.2, as well as emergency medical procedures for treating heat exhaustion and heat stroke.

Noise

The field team is not anticipated to be exposed to excessive noise levels, since the site is residential. However, hearing protection will be available for use as appropriate.

Snake Hazards

Snakes may be encountered at the site. Snake guards and a snake bite kit will be available for use during field activities. Workers should use caution when working in areas which may be inhabited by snakes.

If a worker is bitten by a poisonous snake, the following steps should be taken:

- Keep the victim calm.
- Minimize movement.
- Apply ice to the area bitten.
- Transport victim to the nearest medical facility.

SAFE WORK PRACTICES

To ensure a strong safety awareness program during the inspection, personnel must have adequate training, this health and safety plan must be communicated to the employees, and standing work orders must be developed and communicated to the employees. Sample standing orders for personnel are as follows:

- No smoking, eating, or drinking.

Table 4.1 Suggested Frequency of Physiological Monitoring for
Fit and Acclimatized Workers¹

Temperature	Normal Work Ensemble ²	Impermeable Ensemble
90°F (32/2°C) or above	After Each 45 minutes	After each 15 minutes
87.5°F-90°F (30.8-32/2°C)	After Each 60 minutes	After each 30 minutes
82.5°F-87.5°F (28.1-30.8°C)	After Each 90 minutes	After each 60 minutes
77.5°F-82.5°F (25.3-18.1°C)	After Each 90 minutes	After each 90 minutes
72.5°F-77.5°F (22.5-25.3°C)	After Each 150 minutes	After each 120 minutes

¹ For moderate work, e.g., walking about with moderate lifting and pushing.

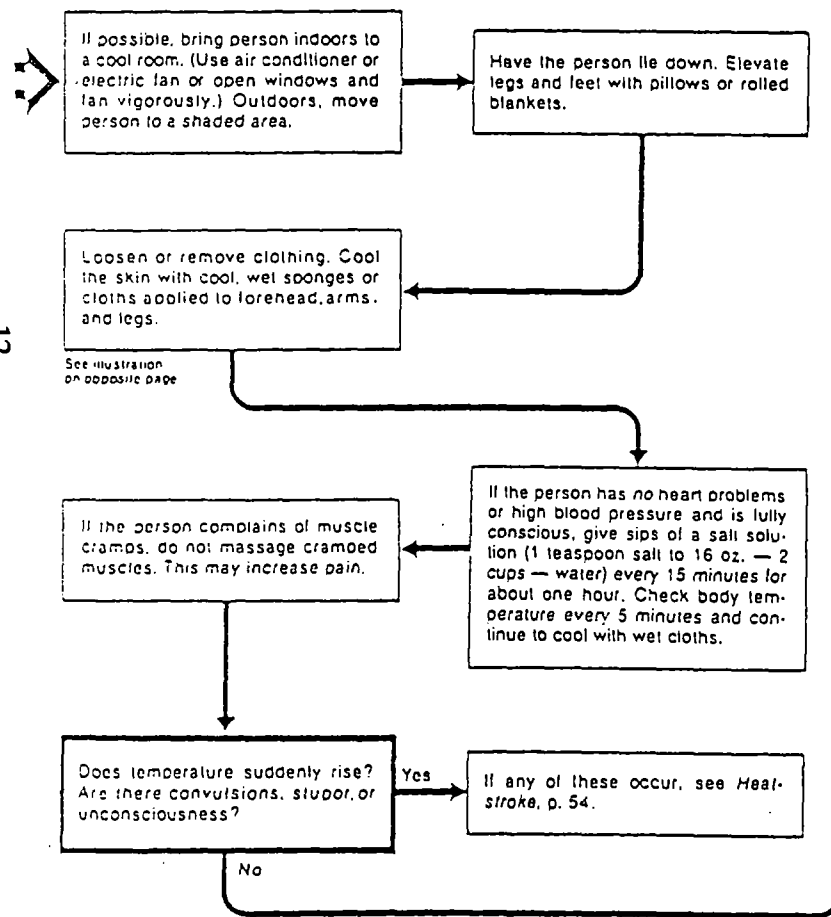
² A normal work ensemble consists of cotton overalls or other cotton clothing with long sleeves and pants.

FIGURE 4.1

53 Heat Exhaustion/ Heat Cramps

Signs & Symptoms: cool, pale, clammy skin / fatigue and lowness/headache/ heavy sweating/weak pulse/near-normal body temperature/nausea. Onset is gradual.

If person is unconscious, see Heatstroke, p. 54.



Calm the person by talking while attending to the problem. Explain what you are doing. Try not to show anxiety; act with confidence. Your calm behavior can help to reassure the sick person.

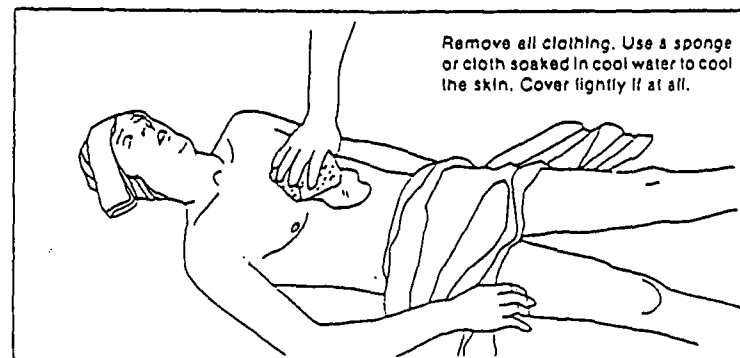
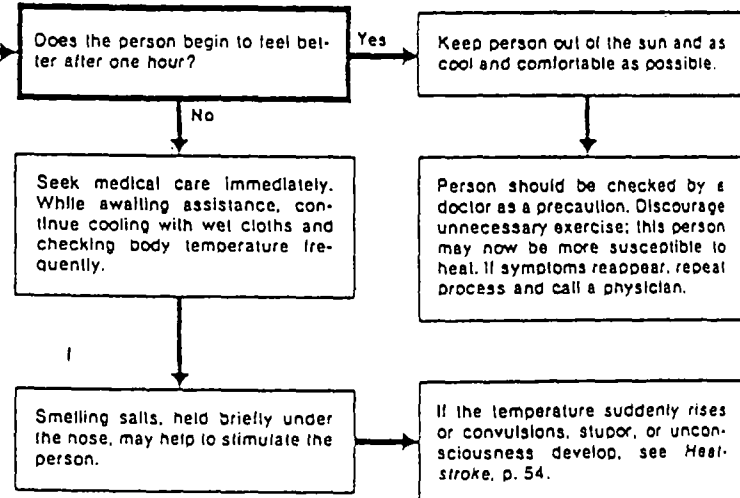


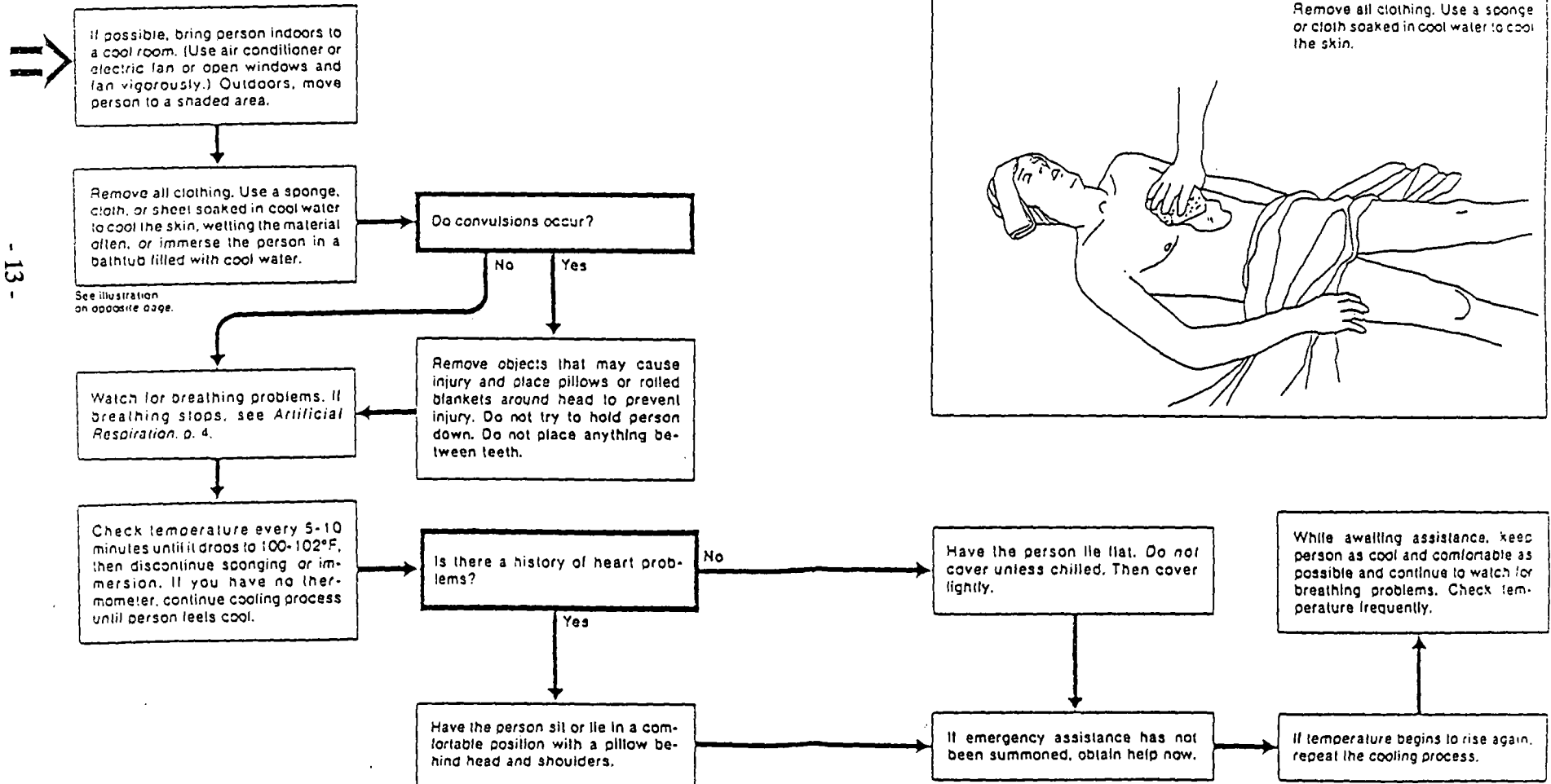
FIGURE 4.2

54 Heatstroke

Signs & Symptoms: red, hot, dry skin/no perspiration/body temperature around 106°F (or very warm to the touch)/strong rapid pulse/stupor or unconsciousness

If there are two or more rescuers, one should obtain emergency assistance while the other is following the procedures outlined below.

Calm the person by talking while attending to the problem. Explain what you are doing. Try not to show anxiety; act with confidence. Your calm behavior can help to reassure the sick person.



- No matches or lighters.
- Use buddy system.
- Avoid walking through puddles or stained soil.
- Discovery of unusual or unexpected conditions will result in immediate evaluation and reassessment of site conditions and health and safety practices.
- Conduct safety briefings prior to on-site work.
- Conduct daily or weekly safety meetings as necessary.
- Take precautions to reduce injuries from heavy equipment and other tools.

Boat Safety

A small flat-bottom boat will be used to provide a working platform for sediment sample retrieval. ~~The boat will be tied to the shore with ropes for stability and maneuvering.~~ Two persons will be in the boat and one person will be on the shore during sampling activities. Life vests will be available in the boat for sampling personnel and a USCG throw cushion will be readily available as a life-saving flotation device. OK 10/9/92
RMP

Tyvek and/or nitrile gloves and rubber boots will be worn by personnel sampling the sediment. Caution will be taken not to stand up in the boat.

SECTION 5

PERSONNEL PROTECTION EQUIPMENT AND MONITORING

RESPIRATORY PROTECTION

The chemicals that may be present at the site are listed in Section 2. Some MSDSs or information sheets for chemicals are available and presented in Appendix B. This is due to insufficient information from records concerning wastes accepted for disposal. To avoid respiratory exposure to known and unknown chemicals, air monitoring will be conducted during the inspection as specified in Section 7. Due to potential that unknown chemicals may be encountered, monitoring of the site will also be conducted by visual and olfactory means to detect any chemicals present at the site. Warning signs, such as headaches and nausea, and observations of unusual vapors, mists, or clouds, will require evacuation of the site. No respirators will be worn on site.

DERMAL PROTECTION

The required personal protection clothing to be used at the site is listed below.

Level D (modified)

- Rubber safety boots will be required during soil sampling and while walking on the site in areas of suspected or potential soil contamination.
- Disposable neoprene or nitrile gloves will be used during all sampling activities.
- Tyvek will be worn during soil sampling events if personnel need to kneel on the ground to collect the samples. Alternately, plastic will be placed on the kneeling surface.

MEDICAL SURVEILLANCE

Personnel involved in field work have undergone an initial physical examination prior to entering a site where a potential exists for exposure to hazardous chemicals, and thereafter at 12-month intervals. A medical certification as to the fitness for employment on hazardous waste projects, or any restrictions on his/her utilization that may be indicated, has been provided by the physician.

SITE-SPECIFIC TRAINING

The site safety officer will be responsible for developing a project occupational hazard training program, providing training to all ES personnel that are to work on the site, and other visiting personnel and documenting in the field notebook that training has occurred. Safety meetings will be held immediately prior to entry on a site. The training will consist of the following topics:

- Names of personnel responsible for site safety and health;
- Safety, health, and other hazards at the site;
- Proper use of personal protective equipment;
- Work practices by which the employee can minimize risk from hazards;
- Safe use of engineering controls and equipment on the site;
- Potential chemicals and acute effects of the chemicals at the site;
- Evacuation routes, signals, and emergency procedures;
- Decontamination procedures;
- Designated area to meet in case work area must be evacuated; and
- Additional items covered under accident prevention.

The project health and safety officer shall be familiar with the operation, calibration, and limitations of all field monitoring equipment. Also, the field team should have the following health and safety items readily available:

- Copy of the health and safety plan,
- First aid kit,
- Eye wash bottle,
- Air monitoring instrument equipped with a flame ionization detector (FID) or photoionization detector (PID),
- Fire extinguisher, and
- Distilled water (for eyewash bottle refill and decontamination procedures).

SECTION 6

ACCIDENT PREVENTION AND CONTINGENCY PLAN

ACCIDENT PREVENTION

All field personnel will receive health and safety training prior to the initiation of any site activities. On a day-to-day basis, individual personnel should be constantly alert for indicators of potentially hazardous situations and for signs and symptoms in themselves and others that warn of hazardous conditions and exposures. Rapid recognition of dangerous situations can avert an emergency. Before beginning the site investigation, a meeting should be held to discuss accident prevention. The discussion should cover but not be limited to:

- Tasks to be performed;
- Time constraints (e.g., rest breaks);
- Hazards that may be encountered, including their effects, how to recognize symptoms or monitor them, concentration limits, or other danger signals; and
- Emergency procedures.

Buddy System

The "buddy system" will be used at all times by all ES field personnel while on site. All activities must be conducted with a partner (buddy) who can:

- Provide his or her partner with assistance;
- Observe his or her partner for signs of chemical or weather exposure; and
- Notify the site investigation manager or others if emergency help is needed.

CONTINGENCY PLAN

Emergency Procedures

In the event that an emergency develops on site, the procedures delineated herein are to be immediately followed. Emergency conditions are considered to exist if:

- Any member of the field crew is involved in an accident or experiences any adverse effects or symptoms of exposure while on site, or
- A condition is discovered that suggests the existence of a situation more hazardous than anticipated.

Chemical Exposure

If a member of the field crew demonstrates symptoms of chemical exposure, the procedures outlined below should be followed:

- Another team member (buddy) should remove the individual from the immediate area of contamination. The buddy should communicate to the field team leader of the chemical exposure. The field team leader should contact the appropriate emergency response agency.
- If the chemical is on the individual's clothing, the chemical should be neutralized or removed if it is safe to do so.
- If the chemical has contacted the skin, the skin should be washed immediately with copious amounts of water.
- In case of eye contact, an emergency eye wash station, if available, should be used. Eyes should be washed for at least 15 minutes.
- All chemical exposure incidents must be reported in writing to the Office Health and Safety Representative. The site safety officer or site investigation manager is responsible for completing the accident report (see Appendix A).

Personal Injury

In case of personal injury at the site, the following procedures should be followed:

- A team member should signal the other team member that an injury has occurred.
- A field team member trained in first aid can administer treatment to an injured worker.
- The victim should then be transported to the nearest hospital or medical center.
- The site investigation manager or site safety officer is responsible for making certain that an accident report form is completed. This form is to be submitted to the Office Health and Safety Representative. Follow-up action should be taken to correct the situation that caused the accident.

Evacuation Procedures

- The site safety officer will determine whether an evacuation is necessary.
- All personnel in the work area should evacuate the area and meet in a pre-designated area.
- All field team personnel should be accounted for.
- Further instructions will then be given by the site safety officer.

SECTION 7

FREQUENCY AND TYPES OF AIR MONITORING

Monitoring for organic vapors/gases will be conducted using a photoionization detector (PID) or flame ionization detector (FID) instrument. Instruments should be calibrated prior to use at the site according to the manufacturer's specifications. The standard calibration gases for the PID instruments is isobutylene. Monitoring of the potential breathing zone around the sampling sites will be performed during the sampling activities as well as periodically during all on-site activities. An action level of 1 ppm above background will be used at all sites due to the potential for encountering chemicals that may be unknown to the investigation team. If 1 ppm above background is encountered on the air monitoring equipment at the site, then the site will be evacuated until vapors dissipate. The need for air monitoring equipment and frequency will be determined on a site-specific basis by anticipated respiratory concerns at the site. Table 7.1 lists the chemicals known to exist at the site and the TLV, PEL, and other pertinent information for each chemical. Table 7.2 lists this information for the decontamination and preservation chemicals which may be used at this site.

Calibration procedures of the air monitoring equipment are presented below.

AIR MONITORING EQUIPMENT CALIBRATION AND MAINTENANCE

All monitoring instruments will be calibrated daily. Calibration data will be noted in the project field notebook. Below are the calibration and procedures for the HNu photoionization detector.

HNu Photoionization Detector

The photoionization detector must be calibrated each day prior to field use. A calibration gas will be taken into the field to perform this routine calibration check. The procedure for the calibration of an HNu photoionization detector is listed below.

1. Attach the probe to the readout unit. Match the alignment key, then twist the connector clockwise until a distinct locking is felt.
2. Turn the FUNCTION switch to the battery check position. Check to ensure that the indicator reads within or beyond the green battery arc on the scale plate. If the indicator is below the green arc or if the red light emitting diode (LED) comes on, the battery must be charged prior to using the instrument.

Table 7.1 Chemicals of Record at the Mobile Waste Controls Site

Chemical	TLV a/	(OSHA) PEL b/	Odor Threshold (ppm)	IDLH c/ (ppm)	Comments
Benzene	0.1 ppm	1 ppm	0.75	3,000	Carcinogen (NIOSH)
Toluene	100 ppm	100 ppm	<1.0	2,000	Hydrocarbon
Ethylbenzene	100 ppm	100 ppm	140	2,000	Aromatic hydrocarbon
2-Nitropropane	ND	10 ppm	140	2,300	Carcinogen (NIOSH)
Chlorobenzene	ND	75 ppm	0.21	2,400	Halogenated hydrocarbons
Cyclohexane	300 ppm	300 ppm	784	10,000	Chloroform-like odor
Xylene	10 ppm	100 ppm	<1.0	1,000	Aromatic hydrocarbon
Aniline	2 ppm	2 ppm	0.5	100	Carcinogen (NIOSH)
Napthalene	10 ppm	10 ppm	N/A	500	Aromatic hydrocarbon
1,4-Dichlorobenzene	ND	75 ppm	15-30	1,000	Carcinogen (NIOSH)
1,1-Diphenylhydrazine	0.06 ppm	0.5 ppm	N/A	50 ppm	Carcinogen (NIOSH)
N-Nitrosodiphenyl amine	N/A	N/A	N/A	N/A	N/A
2-Methyl phenol	N/A	N/A	N/A	N/A	N/A
2,4-Dimethyl phenol	N/A	N/A	N/A	N/A	N/A
2,3-Dimethyl phenol	N/A	N/A	N/A	N/A	N/A
Dimethyl phthalate	5 mg/m3	5 mg/m3	N/A	9,300 mg/m3	Colorless, oily liquid - aromatic odor
Styrene	50 ppm	50 ppm	1.9	5,000	Flammable liquid
Methane	N/A	N/A	N/A	N/A	
Asbestos	2 fibers/cm3	0.2 fiber/cm3	ND	N/A	Carcinogen (NIOSH)

ND = Not determined. Reduce exposure to lowest feasible concentration.

N/A = Not available

ppm = Parts per million

ca = Carcinogen

a/ TLV-TWA = Threshold limit value, time weighted average. OSHA-enforced average air concentration to which a worker may be exposed for an 8-hour workday without harm.

b/ PEL = Permissible exposure limit. Average air concentration (same definition as TLV, above) as recommended by the American Conference of Governmental and Industrial Hygienists (ACGIH).

c/ IDLH = Immediately dangerous to life or health. Air concentration at which an unprotected worker can escape without debilitating injury or health effects. Expressed as ppm unless noted otherwise.

d/ = No information is available on this compound.

Table 7.2 Chemicals of Record for Field Investigations

Chemical	TLV a/ (ppm)	PEL b/ (ppm)	Odor Threshold (ppm)	IDLH c/ (ppm)	Comments
Hexane	50	500		5000	Calibration gas for HMX 271 combustible gas indicator. No problems expected since hexane in cylinder is only 0.14 percent by volume with air.
Isobutylene	1000				Calibration gas for HNU photoionization detector. No problems expected since isobutylene in cylinder isn only 100 ppm balance with air.
Nitric acid	2	2		100	Sample preservative agent. Very corrosive. Avoid contact with skin, eyes, and clothing. Store bottle in an upright secure position.
Hydrochloric acid	(C), 5	(C),5	1-5	100	Sample preservative agent. Very corrosive. Avoid contact with skin, eyes, and clothing. Store bottle in an upright secure position.
Isopropanol	400			12,000	Decontamination fluid. Wear gloves when cleaning equipment.

ppm = parts per million
 Ca = carcinogen
 a/ TLV-TWA = threshold limit value, time weighted average, as recommended by the American Conference of Governmental and Industrial Hygienists (ACGIH).
 b/ PEL = permissible exposure limit. Average air concentration (same definition as TLV, above) OSHA-enforced average air concentration to which a worker may be exposed for an 8-hour workday without harm.
 c/ IDLH = immediately dangerous to life or health. Air concentration at which an unprotected worker can escape without debilitating injury
 (C) = or health effects. Expressed as ppm unless noted otherwise. denotes Ceiling limit

3. To zero the instrument, turn the FUNCTION switch to the STANDBY position, and rotate the ZERO POTENTIOMETER until the meter reads zero. Wait 15 to 20 seconds to ensure that the zero adjustment is stable. If it is not stable, readjust.
4. Check to see that the SPAN POTENTIOMETER is set at the appropriate setting for the probe being used.
5. Set the FUNCTION switch to the desired ppm range.
6. Listen for the fan operation to verify fan function.
7. Check instrument with an organic point source such as a "magic marker" prior to field survey to verify instrument function.
8. Connect one end of the sampling hose to the regulator outlet and the other end to the sampling probe of the HNu.
9. Crack open the regulator valve (to calibration gas).
10. Take reading after 5 to 10 seconds. Adjust the span, if necessary, and record the new span setting in the notebook.
11. If the reading deviates ± 15 percent from the concentration of the calibration gas, the instrument requires maintenance.
12. Results of calibration should be recorded in the logbook.

Recommended maintenance for the HNu is listed below:

<u>Function</u>	<u>Frequency</u>
Wipe down readout unit	After each use
Clean UV light source window	Follow maintenance schedule
Clean ionization chamber	Follow maintenance schedule
Recharge battery	Daily or as use dictates

Foxboro Century Organic Vapor Analyzer Model 128

The Fox organic vapor analyzer (OVA) must be kept hooked up to the battery charger overnight before use. A spare battery is kept in the carrying case and should be kept charged so a backup battery is available.

The carrying case is for transport and storage of the unit and the hydrogen gas regulator. The hydrogen gas tank must be carried with the OVA at all times due to the limited capacity of the on board tank.

The OVA may be calibrated to methane or isobutylene depending on available gasses. The OVA also requires a "zero" adjustment to background levels. Start up procedures are listed under the cover of the unit.

Be sure to have the pump switch and the instrument switch off when not in use. The probe and meter may be disconnected for transport using the adjustable wrench

provided in the carrying case. When refilling the hydrogen gas tank be sure to have the H₂ supply valve closed so as not to damage the on board regulator.

MONITORING REQUIREMENTS AND INSTRUMENT LIMITATIONS

The ES site safety officer will periodically perform and maintain calibration and on-site maintenance records for the direct-reading instruments.

Limitations of PID instruments include susceptibility to cold or wet weather and exposure to moist or wet samples. In these situations, particularly if moisture accumulates on the photoionization lamp, the meter will read less than zero and will not respond to organic vapors. ES field personnel will make every effort to avoid these conditions, but should the PID lamp go out, the field team must exit the site and remain offsite until a new PID is obtained.

SECTION 8

SITE-SPECIFIC DECONTAMINATION PROCEDURES

Prior to leaving the site, personnel protective and sampling equipment will be decontaminated. Decontamination procedures will be conducted as follows:

- Wash and remove goggles or safety glasses (if used),
- Wash and rinse chemical protective boots,
- Wash and remove gloves, and
- Wash hands and face.

Protective gloves will be placed in garbage bags and disposed of appropriately at the conclusion of site activities.

PERSONNEL DECONTAMINATION PROCEDURES

The ES field team will have available a portable decontamination station. It will be set up during field activities if personal protective equipment (gloves, etc.) is being used. The decontamination station will have provisions for collecting disposable protective equipment; for washing boots, gloves, and field instruments and tools; and for washing hands, face, and other exposed body parts. Refuse from decontamination will be properly disposed of.

Decontamination equipment will include, as necessary:

- Plastic buckets and pails
- Scrub brushes
- Alconox detergent
- Isopropyl alcohol
- Paper towels
- Plastic garbage bags
- Potable water.

Appendix A

**Plan Acceptance Form, Accident Report,
Job Safety & Health Protection Notice**

PLAN ACCEPTANCE FORM

SUMMARY OF ACTIVITIES

ACCEPTANCE

I have read the health and safety plan for screening site inspection field work at the Mobile Waste Controls site in Houston, Texas, and agree to abide by the rules and guidelines contained therein.

_____ Name	_____ Signature	_____ Date
_____ Name	_____ Signature	_____ Date
_____ Name	_____ Signature	_____ Date
_____ Name	_____ Signature	_____ Date
_____ Name	_____ Signature	_____ Date
_____ Name	_____ Signature	_____ Date
_____ Name	_____ Signature	_____ Date

JOB SAFETY & HEALTH PROTECTION

The Occupational Safety and Health Act of 1970 provides job safety and health protection for workers by promoting safe and healthful, working conditions throughout the Nation. Provisions of the Act include the following:

Employers

All employers must furnish to employees employment and a place of employment free from recognized hazards that are causing or are likely to cause death or serious harm to employees. Employers must comply with occupational safety and health standards issued under the Act.

Employees

Employees must comply with all occupational safety and health standards, rules, regulations and orders issued under the Act that apply to their own actions and conduct on the job.

The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor has the primary responsibility for administering the Act. OSHA issues occupational safety and health standards, and its Compliance Safety and Health Officers conduct jobsite inspections to help ensure compliance with the Act.

Inspection

The Act requires that a representative of the employer and a representative authorized by the employees be given an opportunity to accompany the OSHA inspector for the purpose of aiding the inspection.

Where there is no authorized employee representative, the OSHA Compliance Officer must consult with a reasonable number of employees concerning safety and health conditions in the workplace.

Complaint

Employees or their representatives have the right to file a complaint with the nearest OSHA office requesting an inspection if they believe unsafe or unhealthful conditions exist in their workplace. OSHA will withhold, on request, names of employees complaining.

The Act provides that employees may not be discharged or discriminated against in any way for filing safety and health complaints or for otherwise exercising their rights under the Act.

Employees who believe they have been discriminated against may file a complaint with their nearest OSHA office within 30 days of the alleged discriminatory action.

Citation

If upon inspection OSHA believes an employer has violated the Act, a citation alleging such violations will be issued to the employer. Each citation will specify a time period within which the alleged violation must be corrected.

The OSHA citation must be prominently displayed at or near the place of alleged violation for three days, or until it is corrected, whichever is later, to warn employees of dangers that may exist there.

Proposed Penalty

The Act provides for mandatory civil penalties against employers of up to \$7,000 for each serious violation and for optional penalties of up to \$7,000 for each nonserious violation. Penalties of up to \$7,000 per day may be proposed for failure to correct violations within the proposed time period and for each day the violation continues beyond the prescribed abatement date. Also, any employer who willfully or repeatedly violates the Act may be assessed penalties of up to \$70,000 for each such violation. A minimum penalty of \$5,000 may be imposed for each willful violation. A violation of posting requirements can bring a penalty of up to \$7,000.

There are also provisions for criminal penalties. Any willful violation resulting in the death of any employee, upon conviction, is punishable by a fine of up to \$250,000 (or \$500,000 if the employer is a corporation), or by imprisonment for up to six months, or both. A second conviction of an employer doubles the possible term of imprisonment. Falsifying records, reports, or applications is punishable by a fine of \$10,000 or up to six months in jail or both.

Voluntary Activity

While providing penalties for violations, the Act also encourages efforts by labor and management, before an OSHA inspection, to reduce workplace hazards voluntarily and to develop and improve safety and health programs in all workplaces and industries. OSHA's Voluntary Protection Programs recognize outstanding efforts of this nature.

OSHA has published Safety and Health Program Management Guidelines to assist employers in establishing or perfecting programs to prevent or control employee exposure to workplace hazards. There are many public and private organizations that can provide information and assistance in this effort, if requested. Also, your local OSHA office can provide considerable help and advice on solving safety and health problems or can refer you to other sources for help such as training.

Consultation

Free assistance in identifying and correcting hazards and in improving safety and health management is available to employers, without citation or penalty, through OSHA-supported programs in each State. These programs are usually administered by the State Labor or Health department or a State university.

Posting Instructions

Employers in States operating OSHA approved State Plans should obtain and post the State's equivalent poster.

Under provisions of Title 29, Code of Federal Regulations, Part 1903.2(a)(1) employers must post this notice (or facsimile) in a conspicuous place where notices to employees are customarily posted.

More Information

Additional information and copies of the Act, specific OSHA safety and health standards, and other applicable regulations may be obtained from your employer or from the nearest OSHA Regional Office in the following locations:

Atlanta, GA	(404) 347-3573
Boston, MA	(617) 565-7164
Chicago, IL	(312) 353-2220
Dallas, TX	(214) 767-4731
Denver, CO	(303) 844-3061
Kansas City, MO	(816) 426-5861
New York, NY	(212) 337-2378
Philadelphia, PA	(215) 596-1201
San Francisco, CA	(415) 744-6670
Seattle, WA	(206) 442-5930

Lynn Martin

Lynn Martin, Secretary of Labor

U.S. Department of Labor

Occupational Safety and Health Administration

Washington, DC
1991 (Reprinted)
OSHA 2203



Appendix B

MSDSs

ANILINE

ANL

Common Synonyms Anilobenzene Aniline oil Phenylamine Blue oil	Only liquid Colorless to yellowish brown Amine odor Sinks slowly in water.
AVOID CONTACT WITH LIQUID AND VAPOR. KEEP PEOPLE AWAY. Wear chemical protective suit with self-contained breathing apparatus. Stop discharge if possible. Stay upwind and use water spray to "knock down" vapor. Call fire department. Isolate and remove discharged material. Notify local health and pollution control agencies.	
Fire	Combustible. POISONOUS GAS IS PRODUCED WHEN HEATED. Vapor may explode if ignited in an enclosed area. Wear chemical protective suit with self-contained breathing apparatus. Extinguish with water, dry chemical, foam, or carbon dioxide. Cool exposed containers with water.
Exposure	CALL FOR MEDICAL AID. LIQUID POISONOUS IF SWALLOWED OR IF SKIN IS EXPOSED. Irritating to eyes. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
Water Pollution	Dangerous to aquatic life in high concentrations. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.
1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-poison, water contaminant Restrict access Should be removed Chemical and physical treatment	2. LABEL 2.1 Category: Poison 2.2 Class: 6
3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: Aromatic amine 3.2 Formula: $C_6H_5NH_2$ 3.3 IMO/IUM Designator: 6.1/1547 3.4 DOT ID No.: 1547 3.5 CAS Registry No.: 62-53-3	4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless to pale brown 4.3 Odor: Aromatic amine-like; characteristic, peculiar; strongly amine-like
5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Respirator for organic vapors, splashproof goggles, rubber gloves, boots. 5.2 Symptoms Following Exposure: ACUTE EXPOSURE: Blue discoloration of finger-tips, cheeks, lips and nose; nausea, vomiting, headache and drowsiness followed by delirium, coma and shock. CHRONIC EXPOSURE: Loss of appetite, loss of weight, headache, visual disturbances; skin lesions. 5.3 Treatment of Exposure: Remove victim to fresh air and call a physician at once. SKIN, EYE CONTACT: Immediately flush skin or eyes with plenty of water for at least 15 min. If cyanosis is present, shower with soap and warm water, with special attention to scalp and fingernails. Administer oxygen until physician arrives. 5.4 Threshold Limit Value: 2 ppm 5.5 Short Term Inhalation Limit: 50 ppm for 30 min.; 5 ppm for 8 hr. 5.6 Toxicity by Ingestion: Grade 3; LD ₅₀ = 50 to 500 mg/kg 5.7 Late Toxicity: None recognized 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin. 5.10 Odor Threshold: 0.5 ppm 5.11 IDLH Value: 100 ppm	

6. FIRE HAZARDS 6.1 Flash Point: 168°F O.C., 156°F C.C. 6.2 Flammable Limits in Air: 1.3%-11% 6.3 Fire Extinguishing Agents: Water, foam, dry chemical, or carbon dioxide 6.4 Fire Extinguishing Agents Not to be Used: Not pertinent 6.5 Special Hazards of Combustion Products: Toxic vapors are generated when heated. 6.6 Behavior in Fire: Not pertinent 6.7 Ignition Temperature: 1418°F 6.8 Electrical Hazard: Not pertinent 6.9 Burning Rate: 3.0 mm/min. 6.10 Adiabatic Flame Temperature: Data not available 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available	10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-P-Q-T-U-X-Y																																				
7. CHEMICAL REACTIVITY 7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Flush with water and rinse with dilute acetic acid 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: 9	11. HAZARD CLASSIFICATIONS 11.1 Code of Federal Regulations: Poison, 8 11.2 HAS Hazard Rating for Bulk Water Transportation: <table> <thead> <tr> <th>Category</th><th>Rating</th></tr> </thead> <tbody> <tr> <td>Fire.....</td><td>1</td></tr> <tr> <td>Health.....</td><td>1</td></tr> <tr> <td>Vapor Irritant.....</td><td>1</td></tr> <tr> <td>Liquid or Solid Irritant.....</td><td>1</td></tr> <tr> <td>Poisons.....</td><td>3</td></tr> <tr> <td>Water Pollution.....</td><td>2</td></tr> <tr> <td>Human Toxicity.....</td><td>2</td></tr> <tr> <td>Aquatic Toxicity.....</td><td>3</td></tr> <tr> <td>Aesthetic Effect.....</td><td>2</td></tr> <tr> <td>Reactivity.....</td><td>4</td></tr> <tr> <td>Other Chemicals.....</td><td>3</td></tr> <tr> <td>Water.....</td><td>0</td></tr> <tr> <td>Self Reaction.....</td><td>0</td></tr> </tbody> </table> 11.3 NFPA Hazard Classification: <table> <thead> <tr> <th>Category</th><th>Classification</th></tr> </thead> <tbody> <tr> <td>Health Hazard (Blue).....</td><td>3</td></tr> <tr> <td>Flammability (Red).....</td><td>2</td></tr> <tr> <td>Reactivity (Yellow).....</td><td>0</td></tr> </tbody> </table>	Category	Rating	Fire.....	1	Health.....	1	Vapor Irritant.....	1	Liquid or Solid Irritant.....	1	Poisons.....	3	Water Pollution.....	2	Human Toxicity.....	2	Aquatic Toxicity.....	3	Aesthetic Effect.....	2	Reactivity.....	4	Other Chemicals.....	3	Water.....	0	Self Reaction.....	0	Category	Classification	Health Hazard (Blue).....	3	Flammability (Red).....	2	Reactivity (Yellow).....	0
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Flammability (Red).....	2																																				
Reactivity (Yellow).....	0																																				
8. WATER POLLUTION 8.1 Aquatic Toxicity: 1020 ppm/1 hr/sunfish/killed/fresh water 10 ppm/96 hr/acornedasmus/TL ₅₀ /fresh water 8.2 Waterlow Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): 150%, 5 days 8.4 Food Chain Concentration Potential: None	12. PHYSICAL AND CHEMICAL PROPERTIES 12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 93.13 12.3 Boiling Point at 1 atm: 363.6°F = 184.2°C = 457.4°K 12.4 Freezing Point: 21°F = -6.1°C = 267.1°K 12.5 Critical Temperature: 708.1°F = 425.6°C = 698.8°K 12.6 Critical Pressure: 770 psia = 52.4 atm = 5.31 MN/m ² 12.7 Specific Gravity: 1.022 at 20°C (liquid) 12.8 Liquid Surface Tension: 45.5 dynes/cm = .0455 N/m at 20°C 12.9 Liquid Water Interfacial Tension: 5.8 dynes/cm = 0.0058 N/m at 20°C 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas): 1.1 12.12 Latent Heat of Vaporization: 106 Btu/lb = 110 cal/g = 4.61 X 10 ⁴ J/kg 12.13 Heat of Combustion: -14,980 Btu/lb = -8320 cal/g = -348.3 X 10 ³ J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: Data not available 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: 0.02 psia																																				
9. SHIPPING INFORMATION 9.1 Grades of Purity: Commercial: 99.5% 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Pressure-vacuum	NOTES																																				

BENZENE

BNZ

Common Synonyms Benzol Benzole		Wetery liquid Colorless Gasoline-like odor
Floats on water. Flammable, irritating vapor is produced. Freezing point is 42°F.		
Avoid contact with liquid and vapor. Keep people away. Wear goggles and self-contained breathing apparatus. Shut off ignition sources and call fire department. Stop discharge if possible. Stay upwind and use water spray to "knock down" vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.		
Fire	FLAMMABLE. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear goggles and self-contained breathing apparatus. Extinguish with dry chemical, foam, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.	
Exposure	CALL FOR MEDICAL AID VAPOR Irritating to eyes, nose and throat. If inhaled, will cause headache, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. LIQUID Irritating to skin and eyes. Harmful if swallowed. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.	
Water Pollution	HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.	
1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-high flammability. Restrict access.		2. LABEL 2.1 Category: Flammable liquid 2.2 Class: 3
3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: Aromatic Hydrocarbon 3.2 Formula: C ₆ H ₆ 3.3 IMO/UN Designation: 3.2/1114 3.4 DOT ID No.: 1114 3.5 CAS Registry No.: 71-43-2		4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Aromatic; rather pleasant aromatic odor; characteristic odor
5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Hydrocarbon vapor canister, supplied air or a nose mask; hydrocarbon-insoluble rubber or plastic gloves; chemical goggles or face splash shield; hydrocarbon-insoluble apron such as neoprene. 5.2 Symptoms Following Exposure: Dizziness, excitation, pallor, followed by flushing, weakness, headache, breathlessness, chest constriction. Come and possible death. 5.3 Treatment of Exposure: SKIN: flush with water followed by soap and water; remove contaminated clothing and wash skin. EYES: flush with plenty of water until irritation subsides. INHALATION: remove from exposure immediately. Call a physician. If breathing is irregular or stopped, start resuscitation, administer oxygen. 5.4 Threshold Limit Value: 10 ppm 5.5 Short Term Inhalation Limits: 75 ppm for 30 min. 5.6 Toxicity by Ingestion: Grade 3; LD ₅₀ = 50 to 500 mg/kg 5.7 Late Toxicity: Leukemia 5.8 Vapor (Gas) Irritant Characteristics: If present in high concentrations, vapors may cause irritation of eyes or respiratory system. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard, if spilled on clothing and allowed to remain, may cause smearing and reddening of the skin. 5.10 Odor Threshold: 4.68 ppm 5.11 IDLM Value: 2,000 ppm		

<div>6. FIRE HAZARDS</div> <div><div>6.1 Flash Point: 12°F C.C.</div><div>6.2 Flammable Limits in Air: 1.3%-7.9%</div><div>6.3 Fire Extinguishing Agents: Dry chemical, foam, or carbon dioxide</div><div>6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective</div><div>6.5 Special Hazards of Combustion Products: Not pertinent</div><div>6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back</div><div>6.7 Ignition Temperature: 1097°F</div><div>6.8 Electrical Hazard: Class I, Group D</div><div>6.9 Burning Rate: 6.0 mm/min.</div><div>6.10 Adiabatic Flame Temperature: Data not available</div><div>6.11 Stoichiometric Air to Fuel Ratio: Data not available</div><div>6.12 Flame Temperature: Data not available</div></div>	<div>10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-T-U-V-W</div>																																				
<div>7. CHEMICAL REACTIVITY</div> <div><div>7.1 Reactivity With Water: No reaction</div><div>7.2 Reactivity with Common Materials: No reaction</div><div>7.3 Stability During Transport: Stable</div><div>7.4 Neutralizing Agents for Acids and Caustics: Not pertinent</div><div>7.5 Polymerization: Not pertinent</div><div>7.6 Inhibitor of Polymerization: Not pertinent</div><div>7.7 Molar Ratio (Reactant to Product): Data not available</div><div>7.8 Reactivity Group: 32</div></div>	<div>11. HAZARD CLASSIFICATIONS</div> <div><div>11.1 Code of Federal Regulations: Flammable liquid</div><div>11.2 NAS Hazard Rating for Bulk Water Transportation:<table><tr><th>Category</th><th>Rating</th></tr><tr><td>Fire</td><td>3</td></tr><tr><td>Health</td><td></td></tr><tr><td>Vapor Irritant</td><td>1</td></tr><tr><td>Liquid or Solid Irritant</td><td>1</td></tr><tr><td>Poisons</td><td>3</td></tr><tr><td>Water Pollution</td><td></td></tr><tr><td>Human Toxicity</td><td>3</td></tr><tr><td>Aquatic Toxicity</td><td>1</td></tr><tr><td>Aesthetic Effect</td><td>3</td></tr><tr><td>Reactivity</td><td></td></tr><tr><td>Other Chemicals</td><td>2</td></tr><tr><td>Water</td><td>1</td></tr><tr><td>Self Reaction</td><td>0</td></tr></table></div><div>11.3 NFPA Hazard Classification:<table><tr><th>Category</th><th>Classification</th></tr><tr><td>Health Hazard (Blue)</td><td>2</td></tr><tr><td>Flammability (Red)</td><td>3</td></tr><tr><td>Reactivity (Yellow)</td><td>0</td></tr></table></div></div>	Category	Rating	Fire	3	Health		Vapor Irritant	1	Liquid or Solid Irritant	1	Poisons	3	Water Pollution		Human Toxicity	3	Aquatic Toxicity	1	Aesthetic Effect	3	Reactivity		Other Chemicals	2	Water	1	Self Reaction	0	Category	Classification	Health Hazard (Blue)	2	Flammability (Red)	3	Reactivity (Yellow)	0
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Flammability (Red)	3																																				
Reactivity (Yellow)	0																																				
<div>8. WATER POLLUTION</div> <div><div>8.1 Aquatic Toxicity:<div>5 ppm/6 hr/minnow/lethal/distilled water</div><div>20 ppm/24 hr/sunfish/TL₅₀/tap water</div></div><div>8.2 Watertown Toxicity: Data not available</div><div>8.3 Biological Oxygen Demand (BOD): 1.2 lb/lb, 10 days</div><div>8.4 Food Chain Concentration Potential: None</div></div>	<div>12. PHYSICAL AND CHEMICAL PROPERTIES</div> <div><div>12.1 Physical State at 15°C and 1 atm: Liquid</div><div>12.2 Molecular Weight: 78.11</div><div>12.3 Boiling Point at 1 atm:<div>176°F = 80.1°C = 353.3°K</div></div><div>12.4 Freezing Point:<div>42.0°F = 5.5°C = 278.7°K</div></div><div>12.5 Critical Temperature:<div>552.0°F = 288.9°C = 562.1°K</div></div><div>12.6 Critical Pressure:<div>710 psia = 48.3 atm = 4.89 MN/m²</div></div><div>12.7 Specific Gravity:<div>0.879 at 20°C (liquid)</div></div><div>12.8 Liquid Surface Tension:<div>28.9 dynes/cm = 0.0289 N/m at 20°C</div></div><div>12.9 Liquid Water Interfacial Tension:<div>35.0 dynes/cm = 0.035 N/m at 20°C</div></div><div>12.10 Vapor (Gas) Specific Gravity: 2.7</div><div>12.11 Ratio of Specific Heats of Vapor (Gas): 1.061</div><div>12.12 Latent Heat of Vaporization:<div>169 Btu/lb = 94.1 cal/g = 3.94 X 10³ J/kg</div></div><div>12.13 Heat of Combustion: -17,460 Btu/lb = -9698 cal/g = -406.0 X 10³ J/kg</div><div>12.14 Heat of Decomposition: Not pertinent</div><div>12.15 Heat of Solution: Not pertinent</div><div>12.16 Heat of Polymerization: Not pertinent</div><div>12.25 Heat of Fusion: 30.45 cal/g</div><div>12.26 Limiting Value: Data not available</div><div>12.27 Reid Vapor Pressure: 3.22 psia</div></div>																																				
<div>9. SHIPPING INFORMATION</div> <div><div>9.1 Grades of Purity:<div>Industrial pure 99 - %</div><div>Thiophene-free 99 - %</div><div>Nitration 99 - %</div><div>Industrial 90% 85 - %</div><div>Reagent 99 - %</div></div><div>9.2 Storage Temperature: Open</div><div>9.3 Inert Atmosphere: No requirement</div><div>9.4 Venting: Pressure-vacuum</div></div>																																					
<div>NOTES</div>																																					

CHLOROBENZENE

CRB

Common Synonyms Monochlorobenzene Phenyl chloride Benzene chloride MCB		Wetery liquid Colorless Sweet, almond odor Sinks in water. Flammable vapor is produced.
Avoid contact with liquid and vapor. Keep people away. Stop discharge if possible. Call fire department. Stay upwind and use water spray to "knock down" vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.		
Fire	FLAMMABLE Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear goggles and self-contained breathing apparatus. Extinguish with dry chemical, foam, or carbon dioxide.	
Exposure	CALL FOR MEDICAL AID. VAPOR If inhaled, will cause coughing or dizziness. Not irritating to eyes, nose and throat. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. LIQUID Irritating to skin and eyes. Harmful if swallowed. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.	
Water Pollution	HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.	
1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Should be removed. Chemical and physical treatment.		2. LABEL 2.1 Category: Flammable liquid 2.2 Class: 3
3. CHEMICAL DESIGNATIONS 3.1 CQ Competibility Class: Halogenated hydrocarbon 3.2 Formula: C ₆ H ₅ Cl 3.3 HMO/UN Designation: 3.3/1134 3.4 DOT ID No.: 1134 3.5 CAS Registry No.: 108-90-7		4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Mild amine odor; sweet, almond-like; aromatic
5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Organic vapor-acid gas respirator where appropriate; neoprene or vinyl gloves; chemical safety spectacles, plus face shield where appropriate; rubber footwear; apron or impervious clothing for splash protection; hard hat. 5.2 Symptoms Following Exposure: Irritating to skin, eyes and mucous membranes. Repeated exposure of skin may cause dermatitis due to detaching action. Chronic inhalation of vapors or mist may result in damage to lungs, liver, and kidneys. Acute vapor exposures can cause symptoms ranging from coughing to transient anesthesia and central nervous system depression. 5.3 Treatment of Exposure: Get medical attention for all eye exposures and any serious over-exposures. Treat the symptoms. INHALATION: remove to clean air; administer oxygen as needed. INGESTION: dilute by drinking water; if vomiting occurs, administer more water. Administer saline laxative. EYES: flush thoroughly with water. SKIN: remove contaminated clothing, wash exposed area with soap and water. 5.4 Threshold Limit Value: 75 ppm 5.5 Short Term Inhalation Limit: Data not available 5.6 Toxicity by Ingestion: Grade 2; LD ₅₀ = 0.5 to 5 g/kg (rat, rabbit) 5.7 Late Toxicity: Data not available 5.8 Vapor (Gas) Irritant Characteristics: Vapors are nonirritating to the eyes and throat. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin. 5.10 Odor Threshold: 0.21 ppm 5.11 IDLH Value: 2,400 ppm		

<div>6. FIRE HAZARDS</div> <div><div>6.1 Flash Point: 84°F C.C.; 97°F O.C.</div><div>6.2 Flammable Limits in Air: 1.3%-7.1%</div><div>6.3 Fire Extinguishing Agents: Carbon dioxide, dry chemical, foam or water spray</div><div>6.4 Fire Extinguishing Agents Not to be Used: Not pertinent</div><div>6.5 Special Hazards of Combustion Products: Burning in open flame can form toxic phosgene and hydrogen chloride gases.</div><div>6.6 Behavior in Fire: Heavy vapor can travel a considerable distance to a source of ignition and flash back.</div><div>6.7 Ignition Temperature: 1184°F</div><div>6.8 Electrical Hazard: Data not available</div><div>6.9 Burning Rate: (est.) 4.6 mm/min.</div><div>6.10 Adiabatic Flame Temperature: Data not available</div></div> <div>(Continued)</div>	<div>10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-T-X</div>																																				
<div>7. CHEMICAL REACTIVITY</div> <div><div>7.1 Reactivity With Water: No reaction</div><div>7.2 Reactivity with Common Materials: No reaction</div><div>7.3 Stability During Transport: Stable</div><div>7.4 Neutralizing Agents for Acids and Caustics: Not pertinent</div><div>7.5 Polymerization: Not pertinent</div><div>7.6 Inhibitor of Polymerization: Not pertinent</div><div>7.7 Molar Ratio (Reactant to Product): Data not available</div><div>7.8 Reactivity Group: 36</div></div>	<div>11. HAZARD CLASSIFICATIONS</div> <div><div>11.1 Code of Federal Regulations: Flammable liquid</div><div>11.2 HAS Hazard Rating for Bulk Water Transportation:<table><thead><tr><th>Category</th><th>Rating</th></tr></thead><tbody><tr><td>Fire.....</td><td>3</td></tr><tr><td>Health.....</td><td></td></tr><tr><td>Vapor Irritant.....</td><td>0</td></tr><tr><td>Liquid or Solid Irritant.....</td><td>1</td></tr><tr><td>Poisons.....</td><td>2</td></tr><tr><td>Water Pollution.....</td><td></td></tr><tr><td>Human Toxicity.....</td><td>1</td></tr><tr><td>Aquatic Toxicity.....</td><td>3</td></tr><tr><td>Aesthetic Effect.....</td><td>2</td></tr><tr><td>Reactivity.....</td><td></td></tr><tr><td>Other Chemicals.....</td><td>1</td></tr><tr><td>Water.....</td><td>0</td></tr><tr><td>Self Reaction.....</td><td>0</td></tr></tbody></table></div><div>11.3 NFPA Hazard Classification:<table><thead><tr><th>Category</th><th>Classification</th></tr></thead><tbody><tr><td>Health Hazard (Blue).....</td><td>2</td></tr><tr><td>Flammability (Red).....</td><td>3</td></tr><tr><td>Reactivity (Yellow).....</td><td>0</td></tr></tbody></table></div></div>	Category	Rating	Fire.....	3	Health.....		Vapor Irritant.....	0	Liquid or Solid Irritant.....	1	Poisons.....	2	Water Pollution.....		Human Toxicity.....	1	Aquatic Toxicity.....	3	Aesthetic Effect.....	2	Reactivity.....		Other Chemicals.....	1	Water.....	0	Self Reaction.....	0	Category	Classification	Health Hazard (Blue).....	2	Flammability (Red).....	3	Reactivity (Yellow).....	0
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Health Hazard (Blue).....	2																																				
Flammability (Red).....	3																																				
Reactivity (Yellow).....	0																																				
<div>8. WATER POLLUTION</div> <div><div>8.1 Aquatic Toxicity: 20 ppm/96 hr/bluegill/T_L/fresh water</div><div>8.2 Waterfowl Toxicity: Data not available</div><div>8.3 Biological Oxygen Demand (BOD): 0.3 lb/lb, 5 days</div><div>8.4 Food Chain Concentration Potential: Data not available</div></div>	<div>12. PHYSICAL AND CHEMICAL PROPERTIES</div> <div><div>12.1 Physical State at 15°C and 1 atm: Liquid</div><div>12.2 Molecular Weight: 112.56</div><div>12.3 Boiling Point at 1 atm: 270°F = 132°C = 405°K</div><div>12.4 Freezing Point: -50.1°F = -45.6°C = 227.6°K</div><div>12.5 Critical Temperature: 678°F = 359°C = 632°K</div><div>12.6 Critical Pressure: 856 psia = 44.6 atm = 4.52 MN/m²</div><div>12.7 Specific Gravity: 1.11 at 20°C (liquid)</div><div>12.8 Liquid Surface Tension: 33 dynes/cm = 0.033 N/m at 25°C</div><div>12.9 Liquid Water Interfacial Tension: 37.41 dynes/cm = 0.03741 N/m at 20°C</div><div>12.10 Vapor (Gas) Specific Gravity: Not pertinent</div><div>12.11 Ratio of Specific Heats of Vapor (Gas): 1.094</div><div>12.12 Latent Heat of Vaporization: 135 Btu/lb = 75 cal/g = 3,140 X 10³ J/kg</div><div>12.13 Heat of Combustion: (est.) 12,000 Btu/lb = 6700 cal/g = 280 X 10³ J/kg</div><div>12.14 Heat of Decomposition: Not pertinent</div><div>12.15 Heat of Solution: Not pertinent</div><div>12.16 Heat of Polymerization: Not pertinent</div><div>12.25 Heat of Fusion: 20.40 cal/g</div><div>12.26 Limiting Value: Data not available</div><div>12.27 Reid Vapor Pressure: 0.5 psia</div></div>																																				
<div>9. SHIPPING INFORMATION</div> <div><div>9.1 Grades of Purity: 99.5%; technical</div><div>9.2 Storage Temperature: Ambient</div><div>9.3 Inert Atmosphere: No requirement</div><div>9.4 Venting: Pressure-vacuum</div></div>																																					
<div>6. FIRE HAZARDS (Continued)</div> <div><div>6.11 Stoichiometric Air to Fuel Ratio: Data not available</div><div>6.12 Flame Temperature: Data not available</div></div>																																					

o-CHLORONITROBENZENE

CNO

Common Synonyms o-Nitrochlorobenzene 1-Chloro-2-nitrobenzene		Solid crystals Yellow Aromatic Sinks in water.
AVOID CONTACT WITH SOLID AND DUST. Keep people away. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Stop discharge if possible. Call fire department. Isolate and remove discharged material. Notify local health and pollution control agencies.		
Fire	Fire COMBUSTIBLE. POISONOUS GASES ARE PRODUCED IN FIRE. Vapor may explode if ignited in an enclosed area. Wear goggles and self-contained breathing apparatus. Extinguish with water, foam, carbon dioxide or dry chemical.	
Exposure	Exposure CALL FOR MEDICAL AID. DUST Irritating to eyes, nose, and throat. If inhaled can cause headache, languor, cyanosis, shallow respiration, and coma. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. SOLID Irritating to skin and eyes. POISONOUS IF SWALLOWED OR SKIN IS EXPOSED. Remove contaminated clothing and shoes. Flush affected area with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting.	
Water Pollution	Water Pollution Dangerous to aquatic life in high concentrations. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.	
1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning - poison, water contaminant. Restrict access. Should be removed. Chemical and physical treatment.		2. LABEL 2.1 Category: Poison 2.2 Class: 6
3. CHEMICAL DESIGNATIONS 3.1 CQ Competibility Class: Not listed 3.2 Formula: C ₆ H ₄ ClNO ₂ 3.3 IMO/UN Designation: 6.1/1578 3.4 DOT ID No.: 1578 3.5 CAS Registry No.: Data not available		4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Solid 4.2 Color: Yellow crystals 4.3 Odor: Aromatic
5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Rubber gloves, self-contained respirator, goggles, protective clothing, and safety shoes. 5.2 Symptoms Following Exposure: INHALATION: Headache, languor, anemia, irritation of nose and throat, cyanosis, shallow respiration, convulsions, and coma. EYES: Irritation. SKIN: Irritation. INGESTION: Forms methemoglobin giving rise to cyanosis and blood changes. 5.3 Treatment of Exposure: Call a physician. INHALATION: Remove from exposure. If indicated give artificial respiration. EYES: Wash with water for at least 15 minutes. Get medical aid. SKIN: Wash with soap and running water. INGESTION: Give emetic, gastric lavage. Get medical aid. 5.4 Threshold Limit Value: 1 mg/m ³ 5.5 Short Term Inhalation Limit: 2 mg/m ³ 5.6 Toxicity by Ingestion: Grade 3; LD ₅₀ = 50 to 500 mg/kg. 5.7 Lethal Toxicity: Weight loss, anemia, weakness and irritability. 5.8 Vapor (Gas) Irritant Characteristics: Data not available 5.9 Liquid or Solid Irritant Characteristics: Data not available 5.10 Odor Threshold: Data not available 5.11 IDLH Value: 1,000 ppm		
6. FIRE HAZARDS 6.1 Flash Point: 261°F C.C. 6.2 Flammable Limits in Air: Data not available 6.3 Fire Extinguishing Agents: Water spray, foam, carbon dioxide, dry chemical (Water or foam may cause frothing). 6.4 Fire Extinguishing Agents Not to be Used: Data not available 6.5 Special Hazards of Combustion: Products: Ignites at high temperatures with evolution of nitrogen oxide and chlorine fumes. 6.6 Behavior in Fire: Volatile solid which gives off flammable vapors when heated; may form explosive mixtures with air. 6.7 Ignition Temperature: Data not available 6.8 Electrical Hazard: Data not available. 6.9 Burning Rate: Data not available (Continued)		
7. CHEMICAL REACTIVITY 7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: Data not available 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Data not available 7.6 Inhibitor of Polymerization: Data not available 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: Data not available		
8. WATER POLLUTION 8.1 Aquatic Toxicity: 96-hour TL ₅₀ Fish, 100 to 1000 ppm. 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): Data not available 8.4 Food Chain Concentration Potential: Data not available		
9. SHIPPING INFORMATION 9.1 Grades of Purity: Data not available 9.2 Storage Temperature: Cool 9.3 Inert Atmosphere: Data not available 9.4 Venting: Data not available		
10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) II		
11. HAZARD CLASSIFICATIONS 11.1 Code of Federal Regulations: Poison, B 11.2 NAB Hazard Rating for Bulk Water Transportation: Not listed 11.3 NFPA Hazard Classification: Category Classification Health Hazard (Blue) 3 Flammability (Red) 1 Reactivity (Yellow) 1		
12. PHYSICAL AND CHEMICAL PROPERTIES 12.1 Physical State at 15°C and 1 atm: Solid 12.2 Molecular Weight: 157.56 12.3 Boiling Point at 1 atm: 474.6°F = 246°C = 519.2°K 12.4 Freezing Point: 90.5°F = 32.5°C = 363.7°K 12.5 Critical Temperature: Data not available 12.6 Critical Pressure: Data not available 12.7 Specific Gravity: 1.368 at 22°C 12.8 Liquid Surface Tension: 43.63 dynes/cm = 0.04363 N/m at 35°C 12.9 Liquid Water Interfacial Tension: Data not available 12.10 Vapor (Gas) Specific Gravity: 5.4 12.11 Ratio of Specific Heats of Vapor (Gas): Data not available 12.12 Latent Heat of Vaporization: Data not available 12.13 Heat of Combustion: Data not available 12.14 Heat of Decomposition: Data not available 12.15 Heat of Solution: Data not available 12.16 Heat of Polymerization: Data not available 12.25 Heat of Fusion: Data not available 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: Data not available		
6. FIRE HAZARDS (Continued) 6.10 Adiabatic Flame Temperature: Data not available 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available		

p-DICHLOROBENZENE


DBP

Common Synonyms Perodichlorobenzene Dichloride Paradi Paradow Paramoth Santochlor		Solid crystals White to clear Mothballs odor
Avoid contact with solid. Call fire department. Isolate and remove discharged material. Notify local health and pollution control agencies.		Sinks in water.
Fire	Combustible. POISONOUS GASES ARE PRODUCED IN FIRE. Wear goggles and self-contained breathing apparatus. Extinguish with water, dry chemical, foam, or carbon dioxide. Cool exposed containers with water.	
Exposure	CALL FOR MEDICAL AID. SOLID Irritating to skin and eyes. Harmful if swallowed. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.	
Water Pollution	HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. Fouling to shorelines. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.	
1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-water contaminant Should be removed Chemical and physical treatment		2. LABEL 2.1 Category: None 2.2 Class: Not pertinent
3. CHEMICAL DESIGNATIONS 3.1 CB Compatibility Class: Halogenated hydrocarbon 3.2 Formula: p-C ₆ H ₄ Cl ₂ 3.3 BAC/UN Designation: 9.0/1502 3.4 DOT ID No.: 1582 3.5 CAS Registry No.: 106-46-7		4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Solid 4.2 Color: White 4.3 Odor: Aromatic
5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Full face mask fitted with organic vapor canister for concentrations over 75 ppm; clean protective clothing; eye protection. 5.2 Symptoms Following Exposure: INHALATION: Irritation of upper respiratory tract; over-exposure may cause depression and injury to liver and kidney. EYE CONTACT: pain and mild irritation. 5.3 Treatment of Exposure: INHALATION: If any ill effects develop, remove patient to fresh air and get medical attention. If breathing stops, give artificial respiration. EYES: flush with plenty of water and get medical attention if ill effects develop. SKIN AND INGESTION: no problem likely. 5.4 Threshold Limit Value: 75 ppm 5.5 Short Term Inhalation Limit: 50 ppm for 60 min. 5.6 Toxicity by Ingestion: Grade 2; LD ₅₀ = 0.5 to 5 g/kg 5.7 Late Toxicity: Data not available 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin. 5.10 Odor Threshold: 15-30 ppm 5.11 IDLH Value: 1,000 ppm		

6. FIRE HAZARDS 6.1 Flash Point: 165°F O.C.; 150°F C.C. 6.2 Flammable Limits in Air: Data not available 6.3 Fire Extinguishing Agents: Water, foam, carbon dioxide or dry chemical. 6.4 Fire Extinguishing Agents Not to be Used: Not pertinent 6.5 Special Hazards of Combustion Products: Vapors are irritating. Toxic chlorine, hydrogen chloride, and phosgene gases may be generated in fires. 6.6 Behavior in Fire: Not pertinent 6.7 Ignition Temperature: Data not available 6.8 Electrical Hazard: Not pertinent 6.9 Burning Rate: 1.3 mm/min. (approx.) 6.10 Adiabatic Flame Temperature: Data not available (Continued)		10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) II
7. CHEMICAL REACTIVITY 7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Bases: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: 30		11. HAZARD CLASSIFICATIONS 11.1 Code of Federal Regulations: OSHA 11.2 HAS Hazard Rating for Bulk Water Transportation: Not listed 11.3 NFPA Hazard Classification: Category Classification Health Hazard (Blue) 2 Flammability (Red) 2 Reactivity (Yellow) 0
8. WATER POLLUTION 8.1 Aquatic Toxicity: 50 ppm*/fish/testes/fresh water 600 mg/1140 freshwater trout/TL ₅₀ /fresh water *No time interval specified 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): Data not available 8.4 Food Chain Concentration Potential: Data not available		12. PHYSICAL AND CHEMICAL PROPERTIES 12.1 Physical State at 16°C and 1 atm: Solid 12.2 Molecular Weight: 147.01 12.3 Boiling Point at 1 atm: 345.6°F = 174.2°C = 447.4°K 12.4 Freezing Point: 130°F = 53°C = 320°K 12.5 Critical Temperature: Not pertinent 12.6 Critical Pressure: Not pertinent 12.7 Specific Gravity: 1.459 at 20°C (solid) 12.8 Liquid Surface Tension: Not pertinent 12.9 Liquid Water Interfacial Tension: Not pertinent 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent 12.12 Latent Heat of Vaporization: Not pertinent 12.13 Heat of Combustion: Not pertinent 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.17 Heat of Fusion: 29.07 cal/g 12.18 Limiting Value: Data not available 12.19 Reid Vapor Pressure: Data not available
9. SHIPPING INFORMATION 9.1 Grades of Purity: Solid: 5 grades, chemical purity close to 100% Liquid: 1-2% orthodichlorobenzene. 9.2 Storage Temperature: Data not available 9.3 Inert Atmosphere: Data not available 9.4 Venting: Data not available		
6. FIRE HAZARDS (Continued) 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available		

MTH

METHANE

Common Synonyms Marsh gas Natural gas	Liquid or gas Colorless Weak odor
Liquid floats and boils on water. Flammable visible vapor cloud is produced.	
Stop discharge if possible. Keep people away. Shut off ignition sources and call fire department. Stay upwind and use water spray to "knock down" vapor. Evacuate area in case of large discharge. Avoid contact with liquid and vapor. Notify local health and pollution control agencies.	
Fire	FLAMMABLE. Flashback along vapor trail may occur. May explode if ignited in an enclosed area. Stop discharge if possible. Cool exposed containers and protect men effecting shutoff with water. Let fire burn.
Exposure	CALL FOR MEDICAL AID. VAPOR Not irritating to eyes, nose or throat. If inhaled, will cause dizziness, difficult breathing, and loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. LIQUID Will cause frostbite. Flush affected areas with plenty of water. DO NOT RUB AFFECTED AREAS.
Water Pollution	Not harmful to aquatic life.
1. RESPONSE TO DISCHARGE (See Response Methods Handbook, CG 446-4) Issue warning - high flammability Restrict access Evacuate area	2. LABEL  Red
3. CHEMICAL DESIGNATIONS 3.1 Synonyms: Marsh gas 3.2 Coast Guard Compatibility Classification: Paraffin 3.3 Chemical Formula: CH ₄ 3.4 IMCO/United Nations Numerical Designation: 2.0/1971	4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquefied gas 4.2 Color: Colorless 4.3 Odor: Mild, sweet
5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Self-contained breathing apparatus for high concentrations; protective clothing if exposed to liquid. 5.2 Symptoms Following Exposure: High concentrations may cause asphyxiation. No systemic effects, even at 5% concentration in air. 5.3 Treatment for Exposure: Remove to fresh air. Support respiration. 5.4 Toxicity by Inhalation (Threshold Limit Value): Not pertinent (methane is an asphyxiant, and limiting factor is available oxygen) 5.5 Short-Term Inhalation Limits: Data not available 5.6 Toxicity by Ingestion: Not pertinent 5.7 Late Toxicity: None 5.8 Vapor (Gas) Irritant Characteristics: Vapors are nonirritating to the eyes and throat. 5.9 Liquid or Solid Irritant Characteristics: No appreciable hazard. Practically harmless to the skin, because it evaporates quickly, but may cause some frostbite. 5.10 Odor Threshold: 200 ppm	

6. FIRE HAZARDS 6.1 Flash Point: Flammable gas 6.2 Flammable Limits in Air: 5.0% - 15.0% 6.3 Fire Extinguishing Agents: Stop flow of gas 6.4 Fire Extinguishing Agents Not to be Used: Water 6.5 Special Hazards of Combustion Products: None 6.6 Behavior in Fire: Not pertinent 6.7 Ignition Temperature: 1004°F 6.8 Electrical Hazard: Class I, Group D 6.9 Burning Rate: 12.5 mm/min.	8. WATER POLLUTION 8.1 Aquatic Toxicity: None 8.2 Waterfowl Toxicity: None 8.3 Biological Oxygen Demand (BOD): None 8.4 Food Chain Concentration Potential: None																												
7. CHEMICAL REACTIVITY 7.1 Reactivity with Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent	9. SELECTED MANUFACTURERS 1. Air Products and Chemicals, Inc. Allentown, Pa. 18105 2. Phillips Petroleum Co. Bartlesville, Okla. 74004 3. Union Carbide Corp. Linde Division 270 Park Ave. New York, N. Y. 10017																												
11. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook, CG 446-3) A-B-C-D-E-F-G	10. SHIPPING INFORMATION 10.1 Grades or Purity: Research grade; pure grade 10.2 Storage Temperature: -260°F 10.3 Inert Atmosphere: No requirement 10.4 Venting: Safety relief																												
12. HAZARD CLASSIFICATIONS 12.1 Code of Federal Regulations: Flammable compressed gas 12.2 NAS Hazard Rating for Bulk Water Transportation: <table><thead><tr><th>Category</th><th>Rating</th></tr></thead><tbody><tr><td>Fire</td><td>4</td></tr><tr><td>Health</td><td></td></tr><tr><td>Vapor Irritant</td><td>0</td></tr><tr><td>Liquid or Solid Irritant</td><td>0</td></tr><tr><td>Poisons</td><td>0</td></tr><tr><td>Water Pollution</td><td></td></tr><tr><td>Human Toxicity</td><td>0</td></tr><tr><td>Aquatic Toxicity</td><td>0</td></tr><tr><td>Aesthetic Effect</td><td>0</td></tr><tr><td>Reactivity</td><td></td></tr><tr><td>Other Chemicals</td><td>0</td></tr><tr><td>Water</td><td>0</td></tr><tr><td>Self-Reaction</td><td>0</td></tr></tbody></table>	Category	Rating	Fire	4	Health		Vapor Irritant	0	Liquid or Solid Irritant	0	Poisons	0	Water Pollution		Human Toxicity	0	Aquatic Toxicity	0	Aesthetic Effect	0	Reactivity		Other Chemicals	0	Water	0	Self-Reaction	0	13. PHYSICAL AND CHEMICAL PROPERTIES 13.1 Physical State at 15°C and 1 atm: Gas 13.2 Molecular Weight: 16.04 13.3 Boiling Point at 1 atm: -258.7°F = -161.5°C = 111.7°K 13.4 Freezing Point: -296.5°F = -182.5°C = 90.7°K 13.5 Critical Temperature: -116.5°F = -82.5°C = 190.7°K 13.6 Critical Pressure: 668 psia = 45.44 atm = 4.60 MN/m ² 13.7 Specific Gravity: 0.422 at = 160°C (liquid) 13.8 Liquid Surface Tension: 14 dynes/cm = 0.014 N/m at = 161°C 13.9 Liquid-Water Interfacial Tension: (est.) 50 dynes/cm = 0.050 N/m at = 161°C 13.10 Vapor (Gas) Specific Gravity: 0.55 - 1.0 13.11 Ratio of Specific Heats of Vapor (Gas): 1.306 13.12 Latent Heat of Vaporization: 219.4 Btu/lb = 121.9 cal/g = 5.100 x 10 ⁵ J/kg 13.13 Heat of Combustion: -21,517 Btu/lb = -11,954 cal/g = -500.2 x 10 ³ J/kg 13.14 Heat of Decomposition: Not pertinent 13.15 Heat of Solution: Not pertinent 13.16 Heat of Polymerization: Not pertinent
Category	Rating																												
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Self-Reaction	0																												
12.3 NFPA Hazard Classifications: Not listed																													
NOTES																													


REVISED 1978

2-NITROPROPANE

NPP

Common Synonyms isonitropropene 2-NP sec-Nitropropene		Liquid Colorless Mild, fruity odor May float or sink in water.
Shut off ignition sources. Call fire department. Avoid contact with liquid and vapor. Keep people away. Stop discharge if possible. Stay upwind. Use water spray to "knock down" vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.		
Fire	Combustible. Containers may explode in fire. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Extinguish with dry chemicals, foam or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.	
Exposure	CALL FOR MEDICAL AID. VAPOR Irritating to eyes, nose and throat. If inhaled will cause headache, dizziness, coughing, or difficult breathing. If in eyes, hold eyelids open and flush with plenty of water. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. LIQUID Irritating to skin and eyes. If swallowed will cause nausea, and vomiting. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting. IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.	
Water Pollution	Effect of low concentrations on aquatic life is unknown. Fouling to shorelines. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.	
1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-high flammability Restrict access Dispense and flush		2. LABEL 2.1 Category: None 2.2 Class: Not pertinent
3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: Nitrocompound 3.2 Formula: $\text{CH}_3\text{CH}(\text{NO}_2)\text{CH}_3$ 3.3 IMDG Designation: Not listed 3.4 DOT ID No.: 2608 3.5 CAS Registry No.: 79-48-9		4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Mild, fruity
5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Self-contained breathing apparatus; goggles or face shield; rubber gloves 5.2 Symptoms Following Exposure: Inhalation causes respiratory tract irritation, headache, dizziness, nausea, and diarrhea. Ingestion causes irritation of mouth and stomach. Contact with liquid irritates eyes and causes mild irritation of skin. 5.3 Treatment of Exposure: INHALATION: In case of pulmonary symptoms, enforce bed rest and give oxygen; get medical attention at once. INGESTION: give large amount of water and induce vomiting. EYES or SKIN: flush with water. 5.4 Threshold Limit Values: 25 ppm 5.5 Short Term Inhalation Limits: Data not available 5.6 Toxicity by Ingestion: Grade 2; oral rat LD ₅₀ = 720 mg/kg 5.7 Late Toxicity: Causes liver cancer in rats 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of skin. 5.10 Odor Threshold: 300 ppm 5.11 IDLH Values: 2,300 ppm		

<div>6. FIRE HAZARDS</div> <div>6.1 Flash Point: 100°F O.C.; 82°F C.C.</div> <div>6.2 Flammable Limits in Air: 2.6% (LFL)</div> <div>6.3 Fire Extinguishing Agents: Foam, dry chemical, carbon dioxide</div> <div>6.4 Fire Extinguishing Agents Not to be Used: "Alcohol" foam; water may be ineffective.</div> <div>6.5 Special Hazards of Combustion Products: Toxic oxides of nitrogen may form in fire.</div> <div>6.6 Behavior in Fire: Data not available</div> <div>6.7 Ignition Temperature: 602°F</div> <div>6.8 Electrical Hazard: Data not available</div> <div>6.9 Burning Rate: Data not available</div> <div>6.10 Adiabatic Flame Temperature: Data not available</div> <div>6.11 Stoichiometric Air to Fuel Ratio: Data not available</div> <div>6.12 Flame Temperature: Data not available</div>	<div>10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-P-Q-T-U-X-Y</div>																																				
<div>7. CHEMICAL REACTIVITY</div> <div>7.1 Reactivity With Water: No reaction</div> <div>7.2 Reactivity with Common Materials: May attack some forms of plastics</div> <div>7.3 Stability During Transport: Stable</div> <div>7.4 Neutralizing Agents for Acids and Caustics: Not pertinent</div> <div>7.5 Polymerization: Not pertinent</div> <div>7.6 Inhibitor of Polymerization: Not pertinent</div> <div>7.7 Molar Ratio (Reactant to Product): Data not available</div> <div>7.8 Reactivity Group: 42</div>	<div>11. HAZARD CLASSIFICATIONS</div> <div>11.1 Code of Federal Regulations: Not listed</div> <div>11.2 NAS Hazard Rating for Bulk Water Transportation:<table><thead><tr><th>Category</th><th>Rating</th></tr></thead><tbody><tr><td>Fire.....</td><td>3</td></tr><tr><td>Health.....</td><td></td></tr><tr><td>Vapor Irritant.....</td><td>1</td></tr><tr><td>Liquid or Solid Irritant.....</td><td>1</td></tr><tr><td>Poisons.....</td><td>1</td></tr><tr><td>Water Pollution.....</td><td></td></tr><tr><td>Human Toxicity.....</td><td>2</td></tr><tr><td>Aquatic Toxicity.....</td><td>3</td></tr><tr><td>Aesthetic Effect.....</td><td>2</td></tr><tr><td>Reactivity.....</td><td></td></tr><tr><td>Other Chemicals.....</td><td>3</td></tr><tr><td>Water.....</td><td>0</td></tr><tr><td>Self Reaction.....</td><td>4</td></tr></tbody></table></div> <div>11.3 NFPA Hazard Classification:<table><thead><tr><th>Category</th><th>Classification</th></tr></thead><tbody><tr><td>Health Hazard (Blue).....</td><td>1</td></tr><tr><td>Flammability (Red).....</td><td>2</td></tr><tr><td>Reactivity (Yellow).....</td><td>2</td></tr></tbody></table></div>	Category	Rating	Fire.....	3	Health.....		Vapor Irritant.....	1	Liquid or Solid Irritant.....	1	Poisons.....	1	Water Pollution.....		Human Toxicity.....	2	Aquatic Toxicity.....	3	Aesthetic Effect.....	2	Reactivity.....		Other Chemicals.....	3	Water.....	0	Self Reaction.....	4	Category	Classification	Health Hazard (Blue).....	1	Flammability (Red).....	2	Reactivity (Yellow).....	2
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<div>8. WATER POLLUTION</div> <div>8.1 Aquatic Toxicity: Data not available</div> <div>8.2 Watertowil Toxicity: Data not available</div> <div>8.3 Biological Oxygen Demand (BOD): Data not available</div> <div>8.4 Food Chain Concentration Potential: None</div>	<div>12. PHYSICAL AND CHEMICAL PROPERTIES</div> <div>12.1 Physical State at 15°C and 1 atm: Liquid</div> <div>12.2 Molecular Weight: 89.09</div> <div>12.3 Boiling Point at 1 atm: 248.5°F = 120.3°C = 393.5°K</div> <div>12.4 Freezing Point: -132°F = -91°C = 182°K</div> <div>12.5 Critical Temperature: Data not available</div> <div>12.6 Critical Pressure: Data not available</div> <div>12.7 Specific Gravity: 0.99 at 20°C (liquid)</div> <div>12.8 Liquid Surface Tension: 30 dynes/cm = 0.030 N/m at 20°C</div> <div>12.9 Liquid Water Interfacial Tension: Data not available</div> <div>12.10 Vapor (Gas) Specific Gravity: 3.06 at 16°C</div> <div>12.11 Ratio of Specific Heats of Vapor (Gas): 1.090 at 20°C</div> <div>12.12 Latent Heat of Vaporization: 176 Btu/lb = 99 cal/g = 4.1 X 10⁴ J/kg</div> <div>12.13 Heat of Combustion: -8,650 Btu/lb = -5,360 cal/g = -224 X 10⁴ J/kg</div> <div>12.14 Heat of Decomposition: Not pertinent</div> <div>12.15 Heat of Solution: Not pertinent</div> <div>12.16 Heat of Polymerization: Not pertinent</div> <div>12.25 Heat of Fusion: Data not available</div> <div>12.26 Limiting Value: Data not available</div> <div>12.27 Reid Vapor Pressure: Data not available</div>																																				
<div>9. SHIPPING INFORMATION</div> <div>9.1 Grades of Purity: Technical, 94 + %</div> <div>9.2 Storage Temperature: Ambient</div> <div>9.3 Inert Atmosphere: No requirement</div> <div>9.4 Venting: Open (flame arrester)</div>	<div>NOTES</div>																																				

Common Synonyms Toluol Methylbenzene Methylbenzol		Watery liquid	Colorless	Pleasant odor
Floats on water. Flammable, irritating vapor is produced.				
Stop discharge if possible. Keep people away. Shut off ignition sources and call fire department. Stay upwind and use water spray to "knock down" vapor. Avoid contact with liquid and vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.				
Fire		FLAMMABLE. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear goggles and self-contained breathing apparatus. Extinguish with dry chemical, foam, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.		
Exposure		CALL FOR MEDICAL AID. VAPOR Irritating to eyes, nose and throat. If inhaled, will cause nausea, vomiting, headache, dizziness, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing difficult, give oxygen. LIQUID Irritating to skin and eyes. If swallowed, will cause nausea, vomiting or loss of consciousness. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.		
Water Pollution		Dangerous to aquatic life in high concentrations. Fouling to shoreline. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.		
1. RESPONSE TO DISCHARGE (See Response Methods Handbook, CG 446-4) Issue warning - high flammability Evacuate area		2. LABEL  Red		
3. CHEMICAL DESIGNATIONS 3.1 Synonyms: Methylbenzene Methylbenzol Toluol 3.2 Coast Guard Compatibility Classification: Aromatic hydrocarbon 3.3 Chemical Formula: C ₆ H ₅ CH ₃ 3.4 IMCO/United Nations Numerical Designation: 3.2/1294		4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Pungent; aromatic, benzene-like; distinct, pleasant		
5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Air-supplied mask; goggles or face shield; plastic gloves. 5.2 Symptoms Following Exposure: Vapors irritate eyes and upper respiratory tract; cause dizziness, headache, anesthesia, respiratory arrest. Liquid irritates eyes and causes drying of skin. If aspirated, causes coughing, gagging, distress, and rapidly developing pulmonary edema. If ingested causes vomiting, griping, diarrhea, depressed respiration. 5.3 Treatment for Exposure: INHALATION: remove to fresh air, give artificial respiration and oxygen if needed; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water. 5.4 Toxicity by Inhalation (Threshold Limit Value): 100 ppm 5.5 Short-Term Inhalation Limits: 600 ppm for 30 min. 5.6 Toxicity by Ingestion: Grade 2; LD ₅₀ 0.5 to 5 g/kg 5.7 Late Toxicity: Kidney and liver damage may follow ingestion. 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin. 5.10 Odor Threshold: 0.17 ppm				

6. FIRE HAZARDS 6.1 Flash Point: 40°F C.C.; 55°F O.C. 6.2 Flammable Limits in Air: 1.27% - 7% 6.3 Fire Extinguishing Agents: Carbon dioxide or dry chemical for small fires, ordinary foam for large fires. 6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective 6.5 Special Hazards of Combustion Products: Not pertinent 6.6 Behavior in Fire: Vapor is heavier than air and may travel a considerable distance to a source of ignition and flash back. 6.7 Ignition Temperature: 997°F 6.8 Electrical Hazard: Class I, Group D 6.9 Burning Rate: 5.7 mm/min.		8. WATER POLLUTION 8.1 Aquatic Toxicity: 1180 mg/l; 96 hr; sunfish; TL _m /fresh water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): 0%, 5 days; 38% (theor.), 8 days 8.4 Food Chain Concentration Potential: None																													
7. CHEMICAL REACTIVITY 7.1 Reactivity with Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent		9. SELECTED MANUFACTURERS 1. Exxon Chemical Co. Houston, Tex. 77001 2. Shell Chemical Co. Petrochemicals Division Houston, Tex. 77001 3. Sun Oil Co. St. Davids, Pa. 19087																													
11. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook, CG 446-3) A-T-U		10. SHIPPING INFORMATION 10.1 Grades or Purity: Research, reagent, nitrations - all 99.8+%; industrial: contains 94+% with 5% xylene and small amounts of benzene and nonaromatic hydrocarbons; 90/120; less pure than industrial. 10.2 Storage Temperature: Ambient 10.3 Inert Atmosphere: No requirement 10.4 Venting: Open (flame arrester) or pressure-vacuum																													
12. HAZARD CLASSIFICATIONS 12.1 Code of Federal Regulations: Flammable liquid 12.2 NAB Hazard Rating for Bulk Water Transportation: <table><tr><th>Category</th><th>Rating</th></tr><tr><td>Fire</td><td>3</td></tr><tr><td>Health</td><td></td></tr><tr><td>Vapor Irritant</td><td>1</td></tr><tr><td>Liquid or Solid Irritant</td><td>1</td></tr><tr><td>Poisons</td><td>2</td></tr><tr><td>Water Pollution</td><td></td></tr><tr><td>Human Toxicity</td><td>1</td></tr><tr><td>Aquatic Toxicity</td><td>3</td></tr><tr><td>Aesthetic Effect</td><td>2</td></tr><tr><td>Reactivity</td><td></td></tr><tr><td>Other Chemicals</td><td>1</td></tr><tr><td>Water</td><td>0</td></tr><tr><td>Self-Reaction</td><td>0</td></tr></table>		Category	Rating	Fire	3	Health		Vapor Irritant	1	Liquid or Solid Irritant	1	Poisons	2	Water Pollution		Human Toxicity	1	Aquatic Toxicity	3	Aesthetic Effect	2	Reactivity		Other Chemicals	1	Water	0	Self-Reaction	0	13. PHYSICAL AND CHEMICAL PROPERTIES 13.1 Physical State at 15°C and 1 atm: Liquid 13.2 Molecular Weight: 92.14 13.3 Boiling Point at 1 atm: 231.1°F = 110.6°C = 383.8°K 13.4 Freezing Point: -139°F = -95.0°C = 178.2°K 13.5 Critical Temperature: 605.4°F = 318.6°C = 591.8°K 13.6 Critical Pressure: 596.1 psia = 40.55 atm = 4.108 MN/m ² 13.7 Specific Gravity: 0.867 at 20°C (liquid) 13.8 Liquid Surface Tension: 29.0 dyne/cm = 0.0290 N/m at 20°C 13.9 Liquid-Water Interfacial Tension: 36.1 dyne/cm = 0.0361 N/m at 25°C 13.10 Vapor (Gas) Specific Gravity: Not pertinent 13.11 Ratio of Specific Heats of Vapor (Gas): 1.089 13.12 Latent Heat of Vaporization: 155 Btu/lb = 86.1 cal/g = 3.61 × 10 ³ J/kg 13.13 Heat of Combustion: -17,430 Btu/lb = -9686 cal/g = -405.5 × 10 ³ J/kg 13.14 Heat of Decomposition: Not pertinent 13.15 Heat of Solution: Not pertinent 13.16 Heat of Polymerization: Not pertinent	
Category	Rating																														
Fire	3																														
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m-XYLENE

XL M

Common Synonyms 1, 3-Dimethylbenzene Xylol		Watery liquid	Colorless	Sweet odor
Floats on water. Flammable, irritating vapor is produced.				
Stop discharge if possible. Keep people away. Call fire department. Avoid contact with liquid and vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.				
Fire	FLAMMABLE Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear self-contained breathing apparatus. Extinguish with foam, dry chemical, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.			
Exposure	CALL FOR MEDICAL AID. VAPOR Irritating to eyes, nose, and throat. If inhaled, will cause headache, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. LIQUID Irritating to skin and eyes. If swallowed, will cause nausea, vomiting, or loss of consciousness. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.			
Water Pollution	HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. Fouling to shoreline. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.			
1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-high flammability Evacuate area Should be removed Chemical and physical treatment		2. LABEL 2.1 Category: Flammable liquid 2.2 Class: 3		
3. CHEMICAL DESIGNATIONS 3.1 CQ Compatibility Class: Aromatic Hydrocarbon 3.2 Formula: $m\text{-C}_6\text{H}_4(\text{CH}_3)_2$ 3.3 IMO/UN Designation: 3.2/1307 3.4 DOT ID No.: 1307 3.5 CAS Registry No.: 106-38-3		4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Like benzene; characteristic aromatic		
5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Approved canister or air-supplied mask; goggles or face shield; plastic gloves and boots. 5.2 Symptoms Following Exposure: Vapors cause headache and dizziness. Liquid irritates eyes and skin. If taken into lungs, causes severe coughing, distress, and rapidly developing pulmonary edema. If ingested, causes nausea, vomiting, cramps, headache, and coma; can be fatal. Kidney and liver damage can occur. 5.3 Treatment of Exposure: INHALATION: remove to fresh air; administer artificial respiration and oxygen if required; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water. 5.4 Threshold Limit Value: 100 ppm 5.5 Short Term Inhalation Limits: 300 ppm for 30 min. 5.6 Toxicity by Ingestion: Grade 3; $\text{LD}_{50} = 50$ to 500 g/kg 5.7 Late Toxicity: Kidney and liver damage. 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin. 5.10 Odor Threshold: 0.05 ppm 5.11 IDLH Value: 10,000 ppm				

<div>6. FIRE HAZARDS</div> <div><div>6.1 Flash Point: 84°F C.C.</div><div>6.2 Flammable Limits in Air: 1.1%-6.4%</div><div>6.3 Fire Extinguishing Agents: Foam, dry chemical, or carbon dioxide</div><div>6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective.</div><div>6.5 Special Hazards of Combustion Products: Not pertinent</div><div>6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.</div><div>6.7 Ignition Temperature: 985°F</div><div>6.8 Electrical Hazard: Class I, Group D</div><div>6.9 Burning Rate: 5.8 mm/min.</div><div>6.10 Adiabatic Flame Temperature: Data not available</div><div>6.11 Stoichiometric Air to Fuel Ratio: Data not available</div><div>6.12 Flame Temperature: Data not available</div></div> <div>7. CHEMICAL REACTIVITY</div> <div><div>7.1 Reactivity With Water: No reaction</div><div>7.2 Reactivity with Common Materials: No reaction</div><div>7.3 Stability During Transport: Stable</div><div>7.4 Neutralizing Agents for Acids and Caustics: Not pertinent</div><div>7.5 Polymerization: Not pertinent</div><div>7.6 Inhibitor of Polymerization: Not pertinent</div><div>7.7 Molar Ratio (Reactant to Product): Data not available</div><div>7.8 Reactivity Group: 32</div></div> <div>8. WATER POLLUTION</div> <div><div>8.1 Aquatic Toxicity: 22 ppm/96 hr/bluegill/TL_{50}/fresh water</div><div>8.2 Waterfowl Toxicity: Data not available</div><div>8.3 Biological Oxygen Demand (BOD): 0 lb/lb, 5 days; 0% (theor.), 8 days</div><div>8.4 Food Chain Concentration Potential: Data not available</div></div> <div>9. SHIPPING INFORMATION</div> <div><div>9.1 Grades of Purity: Research: 99.99%; Pure: 99.9%; Technical: 99.2%</div><div>9.2 Storage Temperature: Ambient</div><div>9.3 Inert Atmosphere: No requirement</div><div>9.4 Venting: Open (flame arrester) or pressure-vacuum</div></div>	<div>10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-T-U</div> <div>11. HAZARD CLASSIFICATIONS</div> <div><div>11.1 Code of Federal Regulations: Flammable liquid</div><div>11.2 HAS Hazard Rating for Bulk Water Transportation:<table><thead><tr><th>Category</th><th>Rating</th></tr></thead><tbody><tr><td>Fire</td><td>3</td></tr><tr><td>Health</td><td></td></tr><tr><td>Vapor Irritant</td><td>1</td></tr><tr><td>Liquid or Solid Irritant</td><td>1</td></tr><tr><td>Poisons</td><td>2</td></tr><tr><td>Water Pollution</td><td></td></tr><tr><td>Human Toxicity</td><td>1</td></tr><tr><td>Aquatic Toxicity</td><td>3</td></tr><tr><td>Aesthetic Effect</td><td>2</td></tr><tr><td>Reactivity</td><td></td></tr><tr><td>Other Chemicals</td><td>1</td></tr><tr><td>Water</td><td>0</td></tr><tr><td>Self Reaction</td><td>0</td></tr></tbody></table></div><div>11.3 NFPA Hazard Classification:<table><thead><tr><th>Category</th><th>Classification</th></tr></thead><tbody><tr><td>Health Hazard (Blue)</td><td>2</td></tr><tr><td>Flammability (Red)</td><td>3</td></tr><tr><td>Reactivity (Yellow)</td><td>0</td></tr></tbody></table></div></div> <div>12. PHYSICAL AND CHEMICAL PROPERTIES</div> <div><div>12.1 Physical State at 15°C and 1 atm: Liquid</div><div>12.2 Molecular Weight: 106.16</div><div>12.3 Boiling Point at 1 atm: 269.4°F = 131.9°C = 405.1°K</div><div>12.4 Freezing Point: -54.2°F = -47.9°C = 225.3°K</div><div>12.5 Critical Temperature: 650.8°F = 343.8°C = 617.0°K</div><div>12.6 Critical Pressure: 513.8 atm = 34.95 pais = 3.540 MN/m²</div><div>12.7 Specific Gravity: 0.864 at 20°C (liquid)</div><div>12.8 Liquid Surface Tension: 28.6 dynes/cm = 0.0286 N/m at 20°C</div><div>12.9 Liquid Water Interfacial Tension: 36.4 dynes/cm = 0.0364 N/m at 30°C</div><div>12.10 Vapor (Gas) Specific Gravity: Not pertinent</div><div>12.11 Ratio of Specific Heats of Vapor (Gas): 1.071</div><div>12.12 Latent Heat of Vaporization: 147 Btu/lb = 81.9 cal/g = 3.43 X 10⁴ J/kg</div><div>12.13 Heat of Combustion: -17,554 Btu/lb = -8752.4 cal/g = -408.31 X 10³ J/kg</div><div>12.14 Heat of Decomposition: Not pertinent</div><div>12.15 Heat of Solution: Not pertinent</div><div>12.16 Heat of Polymerization: Not pertinent</div><div>12.20 Heat of Fusion: 28.01 cal/g</div><div>12.28 Limiting Value: Data not available</div><div>12.27 Reid Vapor Pressure: 0.34 pais</div></div>	Category	Rating	Fire	3	Health		Vapor Irritant	1	Liquid or Solid Irritant	1	Poisons	2	Water Pollution		Human Toxicity	1	Aquatic Toxicity	3	Aesthetic Effect	2	Reactivity		Other Chemicals	1	Water	0	Self Reaction	0	Category	Classification	Health Hazard (Blue)	2	Flammability (Red)	3	Reactivity (Yellow)	0
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NOTES																																					

Appendix C

Quality Assurance Project Plan

Quality Assurance Project Plan
for
Texas Water Commission
Preliminary Assessment/Site Inspection
Program (FY 1992)

Prepared in cooperation with the
Texas Water Commission
and
U.S. Environmental Protection Agency

July 1992

The preparation of this report was financed through grants from the U.S. Environmental Protection Agency through the Texas Water Commission

**QUALITY ASSURANCE PROJECT PLAN
FOR TWC SCREENING SITE INSPECTIONS**

BY

ENGINEERING-SCIENCE, INC.

Approval:

ES project manager

Name

Signature

Date

ES technical director

Name

Signature

Date

TWC project manager

Name

Signature

Date

TWC quality
assurance officer

Name

Signature

Date

Distribution:

Technical Director
Project Manager
Field Team Leader

CONTENTS

	Page
Section 1: Project Description.....	1
Introduction.....	1
Initial Preparations.....	1
Preliminary Assessment Review.....	2
Background Studies	2
Work Plan.....	3
Site Visit	3
SSI Reports	4
Objectives	4
Section 2: Project Organization and Responsibility.....	5
Section 3: Quality Assurance Objectives	9
Introduction.....	9
Precision	9
Accuracy	12
Representativeness	12
Comparability	13
Completeness.....	13
Analytical Parameters and Quantitation Limits	13
Holding Times	13
Section 4: Sampling Procedures.....	16
Sample Collection	17
Groundwater Well Sampling Procedures.....	20
General.....	20
Sampling, Monitoring, and Evacuation Equipment.....	20
Calculation of Well Volume	21
Surface Water Sampling Procedures	22
Tapwater Sampling Procedures.....	22
Surface Soil and Sediment Sampling Procedures	23
Decontamination Procedures.....	23

Record Keeping.....	24
Section 5: Sample Custody.....	25
Field Sample Custody.....	25
Field Logbooks.....	25
Sample TAGS.....	26
Traffic Report Forms.....	27
Introduction - Samples and Sample Numbers.....	27
Completing the Form - Case Documentation.....	28
Completing the Form - Sample Documentation.....	30
Shipping of Samples.....	32
Section 6: Calibration Procedures and Frequency.....	33
Section 7: Analytical Procedures.....	34
Section 8: Data Reduction, Validation, and Reporting.....	36
Field Measurement Data.....	36
Laboratory Data.....	37
Validation.....	37
Reporting.....	37
Section 9: Internal Quality Control Checks and Frequency.....	38
Quality Assurance Batching.....	38
Blanks, Spiked Blanks, and Matrix Spikes.....	38
Trip Blanks.....	38
Field Duplicates.....	38
Equipment Blanks.....	39
Calibration Procedures and Frequency.....	39
Section 10: Performance and System Audits.....	40
Quality System Audit.....	40
Audit Reports.....	40
Section 11: Preventive Maintenance.....	46
Preventive Maintenance Procedures.....	46
Schedules.....	46
Records.....	46
Section 12: Specific Routine Procedures used to Assess Data in Terms of Precision, Accuracy, and Completeness.....	47
Precision.....	47

Accuracy	47
Completeness.....	48
Section 13: Corrective Action.....	49
Initiation of Corrective Action.....	49
Procedure Description	49
Section 14: Quality Assurance Report.....	51
Qua	

FIGURES

2.1 Project Organization.....	6
-------------------------------	---

TABLES

2.2 Schedule of Site Inspection	8
3.1 Matrix Spike/Matrix Spike Duplicate Control Limits for CLP GC/MS Organic Analyses	10
3.2 Surrogate Spike Control Limits for CLP GC/MS Organic Analyses.....	11
3.3 Holding Times and Preservation for Aqueous Samples.....	14
3.4 Holding Times and Preservation for Soil and Sediment Samples	15
4.1 Bottles Required for Aqueous Samples	18
4.2 Bottles Required for Soil and Sediment Samples.....	19
7.1 Analytical Procedures for EPA-CLP	35

SECTION 1

PROJECT DESCRIPTION

INTRODUCTION

This document is a quality assurance project plan (QAPP) for the planning and implementation by Engineering-Science (ES) of screening site inspections (SSI) in Texas for the Texas Water Commission (TWC). This QAPP serves as a controlling mechanism to ensure that all data collected are of satisfactory quality. This QAPP has been prepared in accordance with the U.S. Environmental Protection Agency (EPA) "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans," QAMS-005/80.

Screening site inspections will be conducted in conformance with the requirements of the revised Hazard Ranking System (HRS), Final Rule, dated December 14, 1990. The EPA furnished preliminary guidance prior to promulgating this Final Rule, and this guidance will continue to be used as reference material in collecting data, planning, and conducting onsite activities, and in preparation of the inspection report for each site. This guidance currently includes the following references: (1) *Federal Register*, 40 CFR Part 300, December 14, 1990; (2) "Post SARA Screening Site Inspection, Scope of Work," May 7, 1991, and "Draft Site Inspection Strategy," April 15, 1991, Office of Emergency and Remedial Response, EPA.

For each SSI, field activities will be conducted in two steps. ES will collect information needed to prepare a work plan before the site visit. Following approval of the work plan, ES will visit the site to execute the work plan, including sampling activities.

INITIAL PREPARATIONS

A large percentage of ES field inspectors have prior experience in conducting site investigations; however, all inspectors will undergo a formal training program. Major areas covered during the formal training program will be the objectives of the SSI, preparation for inspection, legal ramifications, health and safety considerations, use of monitoring and sampling equipment in the field, sample shipment and chain-of-custody procedures, the appropriate procedures to be followed relative to any denial-of-entry problems encountered, and other aspects of the inspections to be performed under this project. A

formal EPA-CLP¹ training program will also be held to familiarize project staff with CLP requirements.

Individual site health and safety plans (H&SPs) will be prepared for all sites as part of the work plan development. All H&SPs will be based on ES's health and safety program and ES's understanding of current health and safety regulations.

In most cases, it will be necessary to obtain advance permission to inspect the sites. The TWC will issue written notification of the impending site visit prior to the inspection date, followed by telephone confirmation by the inspectors. The TWC will also provide written credentials for each inspector describing the nature of the project and the authority under which it is conducted. The TWC will provide ES site managers with access authorization before arranging for the site visit.

PRELIMINARY ASSESSMENT REVIEW

Prior to any onsite inspections, the site inspector(s) will review the results of the preliminary assessment (PA), covering all associated file information. The TWC will provide the ES project manager with copies of all available file information, including PAs and tentative dispositions.

BACKGROUND STUDIES

ES inspection personnel will conduct a detailed background study for each site prior to any field activities. The purpose of this study is to collect available file information concerning the activities at the site, hydrogeologic and topographic information pertinent to the site (to be used in a pathway evaluation), and population and ecological information available for the area surrounding the site (to be used in a target evaluation).

Site activities information to be collected during this background study will be drawn primarily from the preliminary assessment (discussed above) and any TWC, Texas Department of Health (TDH), Texas Air Control Board (TACB), and Texas Department of Agriculture (TDA) records concerning the site. Primary sources of hydrogeologic and topographic information to be collected at this time will be topographic maps, city and county highway maps, county and regional water reports, county and regional geologic cross sections, state well construction records, soil maps, etc. Population and ecological information will be collected primarily from census figures, topographic maps, public school records, the Texas Manufacturers Index, U.S. Fish and Wildlife Service endangered species publications, and any available additional information.

The data collected will, whenever possible, be consistent with the requirements of the revised HRS model. At the level of effort appropriate for an SSI, it may not be possible at some sites to collect "HRS quality" data to fulfill every requirement of the model.

The level of effort required for the preliminary portion of the SSI may be greater than that normally required for an SSI. This increased effort may be necessary because the PAs

¹CLP = EPA Contract Laboratory Program

for some of these sites were prepared prior to publication of the current HRS guidance and do not contain complete information. Therefore, additional PA information may need to be collected during the background study task of the SSI.

WORK PLAN

Upon completion of the background search, the lead inspector will prepare a work plan for the site visit. This work plan will be a review of the site information collected during the background study. The work plan will consist of (1) a description of the site, including the history of the site, site area geology and hydrology, a site sketch, and any available photographs; (2) a description of the reported waste handling practices at the site, including the types and quantities of wastes generated (if known); (3) a sampling strategy, defining the number of samples to be collected, the tentative sample locations, the sample matrix (soil, groundwater, etc.), and the analytical methods to be performed on each sample; (4) the comprehensive H&SP; and (5) a site reconnaissance check list. If a site is determined to be a high-profile site (i.e., high level of public scrutiny), ES will include a brief community relations plan and fact sheet for the site.

ES will submit completed work plan to the TWC for approval. Upon written approval, a site visit will be scheduled to execute the approved work plan.

SITE VISIT

SSIs will be conducted during this project at fifteen locations. Each SSI will be conducted by at least two persons, with one inspector designated as the lead inspector. The lead inspector will be responsible for preparing the work plan, planning and conducting the site visit, and preparing the SSI report for that site. The lead inspector will also be responsible for ensuring compliance with the quality assurance plan. One team member will be assigned as site safety officer and will be responsible for ensuring that the site health and safety plan is followed.

The lead inspector will then conduct a detailed interview with site representatives. Interviews with other individuals familiar with the site will be conducted as appropriate before, during, or after onsite reconnaissance activities.

A thorough site reconnaissance will be conducted at each site. The inspection team will visually survey and document the location of the site relative to any roads or other access, drainage systems, surface waters, nearby structures, drums, tanks, monitoring wells, facility boundaries, unique geological features, and other factors which may affect pollutant migration pathways. These factors will be recorded, to the extent practical, on a field site sketch prepared during the site reconnaissance. The facility sketch also will document the locations of sensitive environmental receptors such as onsite and offsite homes and public buildings, undeveloped areas, and drinking water supplies. Indicators of existing problems, such as areas of diseased, dying, or distressed vegetation or discolored soil, also will be noted on the facility sketch. Photographs will be taken as necessary to document observations and onsite activities. Waste management areas associated with site operations will receive a thorough inspection.

Any operator records will be reviewed during the SSI for an indication of the types and quantities of materials disposed of at a given site. Where possible, the party responsible for waste disposal will be determined.

The field team will review the work plan sampling strategy and make changes, as necessary. Environmental samples will be collected at most sites to provide site-specific data on the hazardous substances present as well as pollutant dispersal pathways. The samples collected during the SSIs typically will be from the following sources:

- Onsite and offsite soils
- Groundwater from existing potable or agricultural water or monitoring wells
- Sediment in drainage pathways or receiving waters in runoff pathway from the site
- Environmentally sensitive areas near the site.

The lead inspector will be responsible for collection of the samples and for initiation of the proper chain-of-custody and quality assurance procedures. Samples from the sites will normally be analyzed for typical CLP-RAS organic and inorganic scans of compounds.

SSI REPORTS

Following the site visits and completion of analytical work, ES will prepare the SSI report for each site. The SSI report will contain a description of the site, the operating history of the site, a summary of the preliminary assessment, a description of the data collected, analytical results, QA/QC data, and a discussion of waste sources, pathway characteristics, and potential targets. Supporting documents will be included in the SSI report as appendices and may consist of stratigraphic, hydrogeologic, and topographic information; a site sketch and other pertinent maps; laboratory and chain-of-custody report originals; photographs; and reports from previous investigations at the site.

The SSI reports will be submitted to the TWC as they are completed. ES will make any corrections or additions to the submitted material that the TWC deems necessary and appropriate. An SSI report will be deemed complete and final when final approval is received from the TWC or as indicated in the project contract.

OBJECTIVES

The major objective of this project is to perform and complete screening site inspections at sites judged to be potentially hazardous because of current and past operational and waste disposal activities. The SSI report will provide technical information and data that can be used to determine the score of each respective site according to the Hazard Ranking System.

SECTION 2

PROJECT ORGANIZATION AND RESPONSIBILITY

The project organization chart, Figure 2.1, identifies the key individuals who will be primarily responsible for performance of the project. This organizational structure forms a management team of professionals to oversee the technical aspects of the project, supported by an administrative team who will ensure that personnel and equipment are available to the project when required.

Brian R. Vanderglas, C.P.S.S., will function as ES project manager. Mr. Vanderglas will be responsible for overall coordination of project activities. He also will serve as primary ES contact for the TWC. Joseph D. Bauer will serve as deputy project manager and as a site manager. As deputy project manager, Mr. Bauer will maintain a familiarity with overall project requirements and progress and will serve as the secondary project point of contact. Mr. Bauer will also assist Mr. Vanderglas in project planning and personnel training.

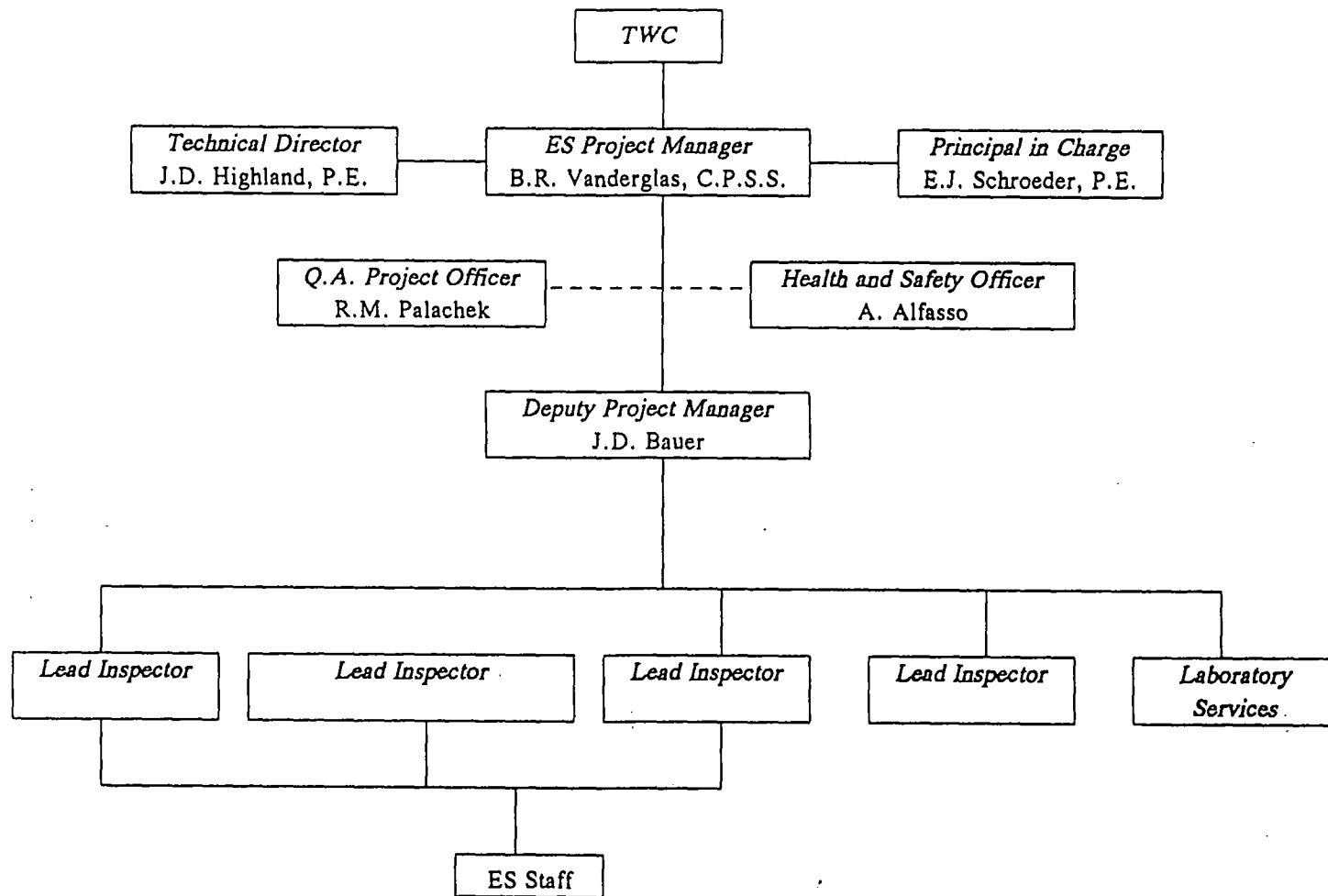
The technical director, J. David Highland, P.E., will review the project work plans, SSI reports, and progress reports. To assure that project quality control is maintained, Randy Palachek will be designated project quality assurance manager, functioning independently of the project manager. Alexis Alfasso will serve as project health and safety manager, independent of the project manager. As such, she will be responsible for ensuring that all onsite activities are conducted in a manner consistent with the project health and safety plans.

Subcontractors may be used to assist in gathering background data and for report production services. Other needs for subcontractor services will be determined throughout the course of this project. The laboratory will be part of the EPA-CLP program, and no drilling services will be performed.

Control of subcontractor work quality, schedules, and budgets will be assured by the following means:

- To assure accountability on a personal level and to avoid the problems associated with diffused responsibilities, the subcontractor will designate a single individual who will function as the subcontractor's project manager.
- The subcontractor's project manager will report directly to the ES project manager.

Figure 2.1 Project Organization



- The subcontractor will establish and maintain a system of controls will be established and maintained by the subcontractor to ensure that the objectives indicated in the project QA/QC plan will be accomplished. ES personnel will periodically inspect this system of controls to ensure compliance by the subcontractor.
- The subcontractor will specify that the ES project manager has the authority to remove any subcontractor personnel from the project if he or she is not performing satisfactorily.

It is anticipated that TWC will stagger site assignments such that a maximum of five are assigned in any 5-week period. The total anticipated time to complete each SSI is 18 weeks. A detailed schedule is presented in Table 2.2. This schedule may be adjusted to meet specific requirements of the TWC.

Table 2.2. Schedule of Site Inspections

Activity	Working Days After Site Assignment
Site assignment	0
Draft work plan complete	12
TWC work plan review	15
Work plan completed and approved	20
Work plan executed (includes travel)	25
Laboratory analyses complete	75
Draft SSI report complete	83
Final SSI report submitted to TWC	90

SECTION 3

QUALITY ASSURANCE OBJECTIVES

INTRODUCTION

A quality assurance (QA) program is essential to assure the quality, controllability, accountability, and traceability of the work being performed for the TWC screening site inspection program. Quality assurance encompasses all actions taken by ES and its subcontractors to achieve results which are accurate, reliable, and legally defensible for all aspects of the project. ES and its subcontractors will adhere to the quality assurance procedures outlined herein and will rigorously implement the QA program throughout the duration of the project.

The primary goal of this QA program is to ensure the accuracy and completeness of the data which ultimately will be used to score and to determine the status of the sites that are investigated. In order to achieve this accuracy and completeness, it is necessary that all sampling, analysis, and data management activities be conducted in accordance with preset standards, and that these activities be reviewed regularly to maintain full compliance with the standards. This program has been designed so that corrective action can be implemented quickly if necessary without causing undue expense or delay to the project. The standards and review procedures which ES will use to attain optimum accuracy and completeness of data are outlined in this plan. All subcontractors to ES will be required to follow these standards and procedures, at a minimum.

The quality assurance objectives for all measurement data include considerations of precision, accuracy, completeness, representativeness, and comparability. Compliance with the QA objectives will be judged individually for each site. QC objectives stated in the EPA CLP statement of work (SOW) are presented in Tables 3.1 and 3.2.

PRECISION

The precision of a measurement is an expression of mutual agreement of multiple measurement values of the same property conducted under prescribed similar conditions. Precision is evaluated most directly by recording and comparing multiple measurements of the same parameter on the same exact sample under the same conditions or a matrix spike and matrix spike duplicate. It is usually expressed in terms of the relative percent difference (RPD). The RPD can be evaluated both internal (laboratory duplicates) and external (field duplicates) to the laboratory. Laboratory duplicate control limits for

Table 3.1. Matrix Spike/Matrix Spike Duplicate Control Limits
for CLP GC/MS Organic Analyses

Matrix Spike Compound	Water		Soil	
	% Recovery	RPD %	% Recovery	RPD %
Volatile organics:				
1,1-Dichloroethene	61-145	14	59-172	22
Trichloroethene	71-120	14	62-137	24
Benzene	76-127	11	66-142	21
Toluene	76-125	13	59-139	21
Chlorobenzene	75-130	13	60-133	21
Semivolatile organics:				
Phenol	12-110	42	26-90	35
2-Chlorophenol	27-123	40	25-102	50
1,4-Dichlorobenzene	36-97	28	28-104	27
N-Nitroso-di-n-propylamine	41-116	38	41-126	38
1,2,4-Trichlorobenzene	39-98	28	38-107	23
4-Chloro-3-methylphenol	23-97	42	26-103	33
Acenaphthene	46-118	31	31-137	19
4-Nitrophenol	10-80	50	11-114	50
2,4-Dinitrotoluene	24-96	38	28-89	47
Pentachlorophenol	9-103	50	17-109	47
Pyrene	26-127	31	35-142	36
Pesticides:				
gamma-BHC	56-123	15	46-127	50
Heptachlor	40-131	20	35-130	31
Aldrin	40-120	22	34-132	43
Dieldrin	52-126	18	31-134	38
Endrin	56-121	21	42-139	45
4,4'-DDT	38-127	27	23-134	50

Table 3.2 Surrogate Spike Control Limits
for CLP GC/MS Organic Analyses

Surrogate Compound	Soil/Sediment % Recovery	Water % Recovery
Volatile organics:		
1,2-Dichloroethane-d4	70-121	76-114
4-Bromofluorobenzene	59-113	86-115
Toluene -d8	84-138	88-110
Semivolatile organics:		
Nitrobenzene-d5	23-120	35-114
Terphenyl-d14	18-137	33-141
2-Fluorobiphenyl	30-115	43-116
2-Fluorophenol	25-121	21-110
2,4,6-Tribromophenol	19-122	10-123
Phenol-d5	24-113	10-110
2-Chlorophenol-d4	20-130*	33-110*
1,2-Dichlorobenzene-d4	20-130*	16-110*

* These limits are for advisory purposes only.

organics are method and laboratory specific, and will be evaluated as part of the EPA-CLP data validation. For metals analysis, a control limit of 20 percent RPD will be used for matrix spike and matrix spike duplicate sample values greater than or equal to 5 times the contract required detection limit. For field duplicates, an RPD of 50 percent will be used as the objective of precision.

Field measurements will be taken of pH, conductivity, temperature, water level, and organic vapor concentration based on HNU² or OVA³ readings. The objective for precision of field data collection methods is to achieve and maintain the factory specifications for the field equipment. For the pH meter, precision will be tested by multiple readings in the medium concerned. Consecutive readings should agree within 0.1 pH unit after the instrument has been field calibrated with standard (NIST-traceable) buffers. The water level indicator readings will be precise within 0.01 foot for duplicate measurements. The HNU or OVA will be calibrated each day prior to field use. If calibration readings deviate 15 percent or more from the concentration of the calibration gas, the instrument will be recalibrated.

ACCURACY

The degree of accuracy of a measurement is based on a comparison of the measured value with the actual true value. Accuracy of an analytical procedure is best determined based on the recoveries of matrix spike, matrix spike duplicate, and surrogate compounds.

The degree of accuracy and the recovery of analyte to be expected for the analyses of QC samples and spiked samples is dependent on the matrix, method of analysis, and the compound or element being determined. The concentration of the analyte relative to the method detection limit is also a major factor in determining the accuracy of the measurement. For metals analysis, spike recovery limits of 75-125 percent will be used. The QC acceptance ranges and limits for GC/MS organic analyses used to assess the accuracy of the data according to CLP protocol are presented in Tables 3.1 and 3.2. These QC acceptance ranges and limits may vary between laboratories and will be evaluated as part of the EPA-CLP data validation.

The objective for accuracy of field measurements is to achieve and maintain factory specifications for the field equipment. The pH meter is calibrated with buffer solutions traceable to National Institute of Standards and Technology (NIST) standards. The HNU or OVA will be calibrated daily with calibration gas.

REPRESENTATIVENESS

Samples taken must be representative of the population. All samples will be collected with dedicated equipment. All sampling equipment will be decontaminated prior to initiating sampling activities. Two types of blanks will be taken. The first type, a trip blank,

²HNU = systems photoionization detector

³OVA = organic vapor analyzer

is a 40 milliliter VOA⁴ vial filled with CLP-specified grade water. The vial will remain capped and accompany all samples for volatile organic analysis. One trip blank (2 VOA vials) will be shipped with each container of appropriate samples. The second type is a rinsate blank and will consist of CLP-specified grade water that has been poured over the equipment after completion of decontamination. The types of blanks collected will be specified by the work plans for each site. The purpose of these blanks is to establish that proper sample bottle preparation, decontamination, and handling techniques have been employed. The blanks will not be counted for the laboratory's quality control protocol for matrix spikes or duplicate samples.

COMPARABILITY

Consistency in the acquisition, handling, and analysis of samples is necessary so the results may be compared with previous and future studies. Concentrations will be reported in a manner consistent with general practices. Standard EPA analytical methods and quality control will be used to support the comparability of analytical results with those obtained in other testing. Calibrations will be performed in accordance with EPA or manufacturer's specifications and will be checked with the frequency specified in the methods.

COMPLETENESS

The completeness of the data is measured as the amount of valid data obtained from the measurement system (field and laboratory) versus the amount of data expected from the system. The EPA-CLP data validation will determine the amount of valid data obtained from each site inspection. At the end of each SSI, completeness of data will be assessed and, if any data omissions are apparent, an attempt will be made to resample the parameters in question. The specific objective for the completeness of this project will be greater than or equal to 90 percent for field and laboratory data for each site.

ANALYTICAL PARAMETERS AND QUANTITATION LIMITS

The analytical parameters and their quantitation limits for use on this project will be determined on a per-site basis. All samples will be analyzed by CLP methods. The quantitation limits may vary since they are matrix and analyte dependent.

HOLDING TIMES

Holding times specified by EPA protocols will be set for samples collected under this program. Tables 3.3 and 3.4 list the types of analyses and their holding times.

⁴VOA = volatile organics analysis

Table 3.3 Holding Times* and Preservation for Aqueous Samples

Analysis	Extraction Times	Analysis Time	Preservation Method
Volatile organics (VOA)	NA	7 days	cool, 4°C
Semivolatile organics (BNA)	7 days	40 days after extraction	cool, 4°C
Pesticides/PCBs	7 days	40 days after extraction	cool, 4°C
Metals**	NA	6 months	HNO ₃ to pH < 2 cool, 4°C
Cyanide	NA	14 days	NaOH to pH > 12 cool, 4°C

* Holding times begin at time of collection.

** Except mercury, analysis time is 28 days.

Table 3.4 Holding Times* and Preservation for
Soil and Sediment Samples

Analysis	Extraction Times	Analysis Time	Preservation Method
Volatile organics (VOA)	NA	14 days	cool, 4°C
Semivolatile organics (BNA)	14 days	40 days after extraction	cool, 4°C
Pesticides/PCBs	14 days	40 days after extraction	cool, 4°C
Metals**	NA	6 months	cool, 4°C
Cyanide	NA	14 days	cool, 4°C

* Holding times begin at time of collection.

** Except mercury, analysis time is 28 days.

SECTION 4

SAMPLING PROCEDURES

After approval of the SSI work plan, the field activities will be executed. At each site, these activities may include shallow soil sampling, sediment sampling, surface water sampling, and groundwater sampling.

Each ES employee involved in sample collection will be trained on how to collect representative samples from every medium which might be encountered. This section discusses the standard sampling procedures. Other sampling procedures may be used as determined necessary by the lead inspector and with approval of the technical director or project officer. Project personnel will receive additional training in proper field documentation and in health and safety procedures. All training will be documented, and records will be maintained by the project manager.

Detailed reports on all sampling activities will be kept in field logbooks. In this book will be noted the date, time, location, and identification of each sample, along with the collector's name, a description of all equipment used and any problems encountered, and general comments of the inspection team. Logbooks also are used to record pertinent information regarding the site itself.

Proper identification and labeling of samples is crucial to an effective sampling program. Immediately upon collection, each sample must be sealed and tagged. The tag should be marked with a sample identification number, station location, type (composite or grab), concentration (low, medium, or high), the parameters requested, collector's name, and the date and time of sample collection.

For many of the screening site inspections, the determining factor of hazard evaluation will be the data provided by sampling and analytical activities. Thus, it is important that QA/QC has been maintained for each sample. The purpose of this section is to outline specific procedures for inspectors to use while acquiring and handling samples during an inspection to ensure that quality data are obtained.

EPA-certified clean sample bottles will be used for sample collection. Custody of these bottles will be maintained by documenting the batch number of the sealed box, documenting opening of the box, and keeping the bottles locked up at all times. If returned to the office, the bottles will be placed in a sealable container and secured with custody seals.

SAMPLE COLLECTION

Regardless of sample type, the following principles and procedures should be adhered to during the sample collection phase of a site inspection:

1. Obtain ice before visiting a site where sample collection is involved.
2. Add appropriate preservatives to the sample bottles if this has not been done previously. The bottles and preservatives are required for each analysis are shown in Tables 4.1 and 4.2.
3. If there is reason to suspect the presence of toxic vapors, precede sampling activities by an initial survey of suspect areas, using appropriate safety gear and a photoionization detector (or equivalent). The potential use of air monitoring equipment should have been specified in the SSI work plan. If it was not, and if organic vapor presence is possible, contact the project manager and project safety manager for possible changes in safety procedures.
4. If possible, collect background samples first, then proceed from the probable least contaminated to most contaminated sampling points.
5. Change disposable gloves between sampling points, placing used gloves in a plastic bag for disposal.
6. When reusing sampling devices, use the specified decontamination procedures between sampling points.
7. At each sampling location (excluding soil boring samples),
 - a. Photograph the collection of samples.
 - b. Record in the logbook:
 - Sample number
 - Photo number
 - Location (show on site sketch)
 - Type of sample
 - Time
 - Relevant observations.
8. If a facility representative requests, they will be allowed the opportunity to collect split samples. If these are desired, place samples directly in different containers at the sampling point rather than splitting them at a later time.
9. If samples can be collected in a short period of time (less than 20 minutes), leave the cooler with ice at the car for convenience. Before placing samples in the iced cooler:

Table 4.1 Bottles Required for Aqueous Samples

Analysis	Required Volume	Container Type
Volatile Organics	80 mL	2 40-mL glass vials
Extractable Organics (BNA and pesticide/PCB)	1 gallon	2 80-ounce or 4 1-liter amber glass bottles
Metals	1 liter	1 1-liter polyethylene bottle
Cyanide	1 liter	1 1-liter polyethylene bottle

Table 4.2 Bottles Required for Soil and Sediment Samples

Analysis	Required Volume	Container Type
Volatile Organics	240 mL	2 120-mL widemouth glass vials
Extractable Organics (BNAs and pesticide/PCBs)	6 ounces	1 8-ounce or 2 4-ounce widemouth glass jars
Metals and Cyanide	6 ounces	1 8-ounce or 2 4-ounce widemouth glass jars

- a. Complete the sample tags and labels, and place clear tape over the sample labels to protect the writing from moisture.
 - b. Double check the pH of all preserved water samples (exclusive of VOA samples).
 - c. Place a custody seal around the bottle cap.
 - d. Wrap the sample containers with plastic foam, bubble pack, or equivalent to protect against breakage.
 - e. Place the sample containers in plastic Ziploc® bags or equivalent to prevent melted ice from contacting the container.
10. Remove water from melted ice frequently, and replace with fresh ice. Place ice in plastic Ziploc or sealable bags to minimize water leakage during shipment.

The following standard operating guidelines are presented for specific sample types.

GROUNDWATER WELL SAMPLING PROCEDURES

General

The primary consideration is to obtain a representative sample of the groundwater zone of interest without mixing the sample with stagnant (standing) water in the well casing.

To safeguard against collecting nonrepresentative stagnant water in a sample, the following guidelines and techniques will be adhered to during sample withdrawal:

1. As a general rule, all monitoring wells should be pumped or bailed before samples are withdrawn. The wells will be purged until consistent readings of the pH, conductivity, and temperature are measured. Evacuation of a minimum of one volume of water in the well casing is recommended for a representative sample. A maximum of three volumes will be purged in the event the groundwater parameters don't stabilize.
2. For wells that can be pumped or bailed to dryness with the sampling equipment, the well should be evacuated and allowed to recover to 85 percent of original water level before sample withdrawal.
3. The purge waters will be either contained at the site until analytical results are received, which would enable disposition of the water, or they will be deposited into an onsite drainage system, depending on the anticipated risk and subject to TWC approval.

Sampling, Monitoring, and Evacuation Equipment

Sample containers will conform to EPA regulations for the appropriate constituents.

The following equipment should be on hand when sampling wells:

1. Coolers for sample shipping and cooling, chemical preservatives, and appropriate packing cartons and filler.
2. Thermometer, pH paper and meter, camera and film, labels, appropriate keys (for locked wells), tape measure, water level indicators, and specific-conductivity meter.
3. Pumps (if needed).
4. Bailers and monofilament line with tripod-pulley assembly (if necessary). Bailers will normally be used to obtain samples from shallow and deep groundwater wells, although samples may be obtained directly from the pump discharge line for high-yielding monitoring wells and wells with dedicated pumps.
5. Decontamination solutions – tap water, distilled water, Alconox, isopropanol, CLP-specified grade water.

Sample withdrawal methods may require the use of pumps, compressed air, bailers, and samplers. Ideally, sample withdrawal equipment should be completely inert, economical to manufacture, easily cleaned, and reused, able to operate at remote sites in the absence of power resources, and capable of delivery variable rates for well flushing and sample collection.

Calculation of Well Volume

Calculations are to be made according to the following steps:

1. Obtain all available information on well construction (casing, screens, etc.).
2. Determine well or casing diameter.
3. Determine static water level (feet below ground level).
4. Determine depth of well.
5. Calculate number of linear feet of static water (total depth minus the static water level).
6. Calculate static volume in gallons: $V = Tr^2 (0.163)$, where T is linear feet of static water, and r is the inside radius of the well of casing in inches.
7. Determine the minimum amount to be evacuated before sampling.

If possible, a number of observations will be made when groundwater sampling is to take place. Some of the information can be gained from file review prior to a site inspection.

1. Note if monitoring wells are locked. Arrangements must be made to secure keys or to remove locks by other means and resecure the wells.
2. Note well diameters to ensure that a bailer of the proper size will be available. The diameter is also necessary for calculating the wells' static water volume.
3. Note the type of casing materials – PVC, steel, etc.

4. Note any observable physical characteristics of the groundwater as it is being sampled – color, odor, turbidity, etc.
5. Measure the static water level of each well before sampling, if possible. This is best accomplished with an electronic water level indicator. Similarly, determine the total depth of the well before sampling. Obtain these measurements whether or not well logs are available, since the measurements are required in calculating the static water volume of the well.
6. Measure the pH, temperature, and specific conductivity of the groundwater being sampled. To avoid possible contamination problems, measure temperature, pH, and specific conductivity on a portion of groundwater which is not in a sample container to be sent out for analysis.

SURFACE WATER SAMPLING PROCEDURES

Surface water sampling locations will be selected according to the probability that they will show contaminants migrating from a site. In general, samples will be taken from streams running through or adjacent to a site, including those bodies of water which may receive surface runoff or leachate from a site. Samples will only be collected where it can be shown that the site provides the only source of contaminants to the surface water body. Care will be taken in sampling leachate breakouts, which may have high concentrations of contaminants. Surface water will also be sampled from any adjacent standing bodies of water such as ponds, lakes, or swamps which might be receiving contaminants.

Grab samples will be collected using a pond sampler. The pond sampler, described in "Samplers and Sampling Procedures for Hazardous Waste Streams," EPA 1980 (EPA-600/2-80-018), consists of a beaker attached with a clamp to a telescoping aluminum pole. This sampler allows a sample to be collected several feet from the bank or berm.

TAPWATER SAMPLING PROCEDURES

Well depth, casing size, and holding-tank volume will be obtained if possible to calculate the volume of the system, and the system will be evacuated by removing three to five volumes by letting a tap run. If the well depth, casing size, or holding-tank volume is not readily available or is unknown, a tap will be opened and allowed to run for 15 minutes. The well evacuation strategy will be documented in the field book.

Samples will be collected in containers in accordance with the sampling guidelines from a point as close to the well as possible and before the water is processed through any water treatment devices (e.g., softeners or filters). In many cases this may not be possible. When samples must be collected after the filtration or softener system, the situation will be documented in the logbook. The exact type of filtration system or softener in use will be recorded. To determine whether desorption of the filters is occurring, samples may be collected after water has passed through treatment devices.

If samples are taken from direct water main connections, the spigot will be flushed for 2 to 3 minutes (15 to 30 minutes is not necessary) to clear the service line. Water

parameters (temperature, conductivity, pH) will be measured. Well purging will be considered complete after 3 consistent readings.

Samples will *not* be collected from spigots after treatment (except as noted above) or from spigots that leak around their stems or that contain aeration devices or screens within the faucet.

For private wells equipped with hand or mechanical pumps, the water will be pumped for 5 minutes before the sample is collected directly from the discharge line.

SURFACE SOIL AND SEDIMENT SAMPLING PROCEDURES

Areas selected for sampling will be stratigraphically located in order to collect a representative fraction of the soils with the minimum of samples. A surface inspection of the subject area will be made to locate pertinent features (e.g., rock outcrops, drainage patterns, surface runoff, erosion areas, etc.) and to evaluate the relationship among these features and potential sources of pollution. The locations of sediment deposition areas are good indicators of surface runoff direction.

A method of obtaining a shallow soil sample is to use stainless steel spoon or shovel. The soil sample will then be placed in the appropriate glass bottle. After the sample has been collected, the top of the bottle and lid will be wiped with a clean paper towel to ensure a tight seal. Samples for VOA analysis will be collected first, followed by samples for BNA's, pesticides/PCBs and metals. If metals are the primary concern at a site, the metals sample will be collected second. Care will be taken to fill the 120 mL VOA sample as full as possible to minimize headspace. A decontaminated shovel or spade can be used to uncover the top 6 inches of soil so the sample can be collected from beneath the surface.

Sampling equipment such as stainless steel scoops and spoons must be decontaminated according to the specified procedures between sampling locations to avoid cross contamination. Where possible, dedicated sampling equipment will be used.

DECONTAMINATION PROCEDURES

To prevent contamination of samples by materials originating from the variety of onsite sampling tools and equipment, all sampling equipment (sample scoops, bailers, surface water dippers) will be decontaminated. Dedicated sampling equipment will be available for each sample planned. All equipment to be used at one site will be decontaminated in one batch prior to initiating any sampling. Each sampling tool will be placed in an individual sealable plastic bag or wrapped in a large plastic trash bag and closed with a custody seal. In the event that additional sampling is required or a sampling tool's integrity is questionable, then that tool will go through a decontamination process. The decontamination procedures are as follows:

1. Rinse equipment with tap (potable) water.
2. Clean the equipment with a brush in a solution of laboratory-grade detergent (Liquinox, Alconox, or equivalent) and potable water.

3. Rinse with tap water.
4. Rinse with 10 percent nitric acid solution, (trace metals grade) if analyzing for metals.
5. Rinse with distilled or deionized water.
6. If analyzing for organics, rinse with reagent-grade isopropanol.
7. Rinse with deionized water.
8. Air dry.
9. Place in plastic sealable bag if immediate use is not expected.

The sampling equipment will be cleaned as described above before its use for collecting each sample. After sampling is complete, each sample tool will be cleaned with a detergent wash and rinsed with distilled water to remove any potential contamination.

RECORD KEEPING

All information pertinent to sampling will be recorded in a logbook. This book will be bound and have consecutively numbered pages. Entries in the logbook will be made in ink and will include, at a minimum, a description of all activities, the names of all individuals involved (sampling and oversight), date and time of sampling, weather conditions, any problems, and all field measurements.

SECTION 5

SAMPLE CUSTODY

Sample custody is an integral part of any sample collection and analysis plan. Several steps for maintaining sample custody apply to field sample custody versus laboratory sample custody. First, in the field, the appropriate collection, identification, preservation, and shipment of the samples will ensure sample integrity. The second step is correct sample bottle identification and preparation. Lastly, when samples reach the laboratory, they are assigned a laboratory number and maintained at 4°C until sample preparation and analyses can be performed.

FIELD SAMPLE CUSTODY

Sample custody and documentation procedures described in this section will be followed throughout all sample collection for all TWC SSIs. Components of sample custody are field logbooks, sample labels, sample tags, and chain-of-custody forms. CLP organic and inorganic traffic report forms will serve as chain-of-custody forms for this project.

FIELD LOGBOOKS

Bound field logbooks will be maintained by the site manager and other team members to provide a daily record of significant events, observations, and measurements during the field investigation. Each page in the logbook will be initialed by the author and signed after the last entry of each day. All entries by persons other than the author will be initialed or signed. All entries will be signed and dated.

All information pertinent to the field survey and sampling will be recorded in the logbooks. The logbooks will be bound books with consecutively numbered pages that are at least 4½ inches by 7 inches in size. Waterproof ink will be used in making all entries. Entries in the logbook will include, at the minimum, the following:

- General information:
 - Names and titles of author and assistant, date and time of entry, and physical/environmental conditions during field activity
 - Location of sampling activity
 - Name and title of field crew.

- Sampling documentation:
 - Sample medium (e.g., soil)
 - Description of sampling point(s)
 - Date and time of collection
 - Sample identification number(s).
- Other information:
 - Names and titles of any site visitors or interviewees
 - Field observations and unusual field conditions
 - Any field measurements made (such as pH, conductivity, temperature) including specific calibration data and documentation of field equipment (serial number, decontamination, etc.)
 - Sample handling (e.g., preservation with ice).

None of the field logbooks or chain-of-custody documents will be destroyed or discarded, even if they are illegible or contain inaccuracies that require a replacement document. If a previously recorded value is discovered to be incorrect, the wrong information will be crossed out in such manner that it is still legible, the correct value written in, and the change initialed and dated. If the change is made by someone other than the original author or if the change is made on a subsequent day, a reason for the change will be recorded at the then-current active location in the logbook, with cross-references.

SAMPLE TAGS

All samples collected at the site will be placed in an appropriate sample container for preservation and shipment to the designated laboratory. Each sample will be identified with a separate identification label and tag. The bottles and ice chests will be sealed with custody seals. Sample identification tags and custody seals will be provided by the CLP sample management office. The tag will indicate if the sample is a split sample. The label will contain the sample number. The following information will be recorded on the tag:

- Analyses to be performed
- Sample identification number
- Source/location of sample
- Type of sample (composite or grab)
- Preservatives used (ice)
- Date
- Time (a four-digit number indicating the 24-hour clock time collection; for example, 1430 for 2:30 P.M.)

- Sampler's signature
- CLP case number.

Once the tag is complete, a custody seal will be placed over the lid of the bottle. The custody seal will show the date and sampler's signature.

TRAFFIC REPORT FORMS

Introduction - Samples and Sample Numbers

The CLP organic and inorganic multi-sample traffic reports/chain-of-custody forms (TRs) document samples shipped to CLP laboratories. They also enable the sample management office (SMO) and the region to track samples and ensure that the samples are shipped to the appropriate contract laboratory. TRs will be used each time routine analytical services (RAS) samples are shipped to a CLP laboratory. The TRs may document up to ten samples shipped to one CLP laboratory under one case number and RAS analytical program.

The TR includes a chain-of-custody record which is located at the bottom of the form. The form is used as physical evidence of sample custody. According to EPA enforcement requirements, official custody of samples must be maintained and documented from the time of collection until the time the samples are introduced as evidence in the event of litigation. The field team leader is responsible for the care and custody of the sample until sample shipment.

A sample is considered to be in custody if any of the following criteria are met:

1. The sample is in possession of the sampling team or is in view after being in possession.
2. The sample was in possession and then locked up or sealed to prevent tampering.
3. The sample is in a secured area, and security is documented.

CLP sample types are defined by the RAS analytical program. There are currently three organic/inorganic programs. Low/medium concentration inorganic, low/medium concentration organic, and high concentration organic. Low/medium inorganic samples may be analyzed for total metals, cyanide, or both. Low/medium organic samples may be analyzed for VOAs, base/neutral/acid (BNAs), pesticide/PCBs, or any combination of these. High concentration organic samples may be analyzed for VOAs, BNA/pesticide/PCBs, and aroclors/toxaphenes. Inorganic samples are documented on inorganic TRs. Organic and high concentration samples are documented on organic TRs.

A CLP sample is one matrix – water or soil – never both. The CLP sample is further defined as consisting of all the sample aliquots from one station location, for each matrix and RAS analytical program.

The CLP generates unique sample numbers that must be assigned to each organic and inorganic sample. The unique CLP sample numbers are printed at SMO on adhesive

labels and distributed to the region as requested. The field team leader will be responsible for assigning this critical sample number correctly and transcribing it accurately on the TR.

Organic sample numbers are in the format XX123, and have ten labels per strip: four for extractables, two for VOAs, and four blank (extra). UNUSED LABELS will be destroyed to prevent duplication of sample numbers.

Inorganic sample numbers are in the format MXX123 and have seven labels per strip – two for total metals, two for cyanide, and three extra (see attachment 1). Remember that the unique sample number must only be used once. EXTRA LABELS will be destroyed.

Use only the labels provided by region VI. CLP sample numbers are alphabetically coded to correspond with each region as follows:

Letter code		Region	Letter Code		Region
Organic	Inorganic		Organic	Inorganic	
A	MA	I	F	MF	VI
B	MB	II	G	MG	VII
C	MC	III	H	MH	VIII
D	MD	IV	Y	MY	IX
E	ME	V	J	MJ	X

Remember:

- TRs must be used for each case number with every shipment of samples to each CLP laboratory.
- Organic samples, high concentration samples, and inorganic samples are assigned separate, unique sample numbers. Each sample consists of all the sample aliquots from a sample station location for analysis in one of the three analytical programs.
- A CLP RAS sample will be analyzed as either a water or a soil sample.
- Prevent accidental duplication of sample numbers by destroying unused labels.
- Use the sample numbers specific to region VI.
- Call SMO (telephone number 703/557-2490 or 703/684-5678) if you have any questions about using TRs.

Completing the Form - Case Documentation

Instructions for filling out the traffic report/chain of custody are as follows:

Box No. 1

- Project code/site information:
 - Enter the project code, account code, regional information (VI), site name, city, and state in the designated spaces.

Box No. 2

- Regional information:

- Enter the region number (6), the name of your sampling company (ES), and your name and signature in the designated spaces.

Box No. 3

- Type of activity:

- Check funding level of sampling. Next, check the code which describes the task of the sampling mission:

Funding Level

SF	—	Superfund
PRP	—	Potential responsible party
ST	—	State
FED	—	Federal

Pre-Remedial

PA	—	Preliminary assessment
SSI	—	Screening site investigation
LSI	—	Listing site investigation

Remedial

RIFS	—	Remedial investigation feasibility study
RD	—	Remedial design
O&M	—	Operations and maintenance
NPLD	—	National priorities list delete

Removal

CLEM	—	Classic emergency
REMA	—	Removal assessment
REM	—	Removal
Oil	—	Oil response
UST	—	Underground storage tank response

Box No. 4

Shipping Information:

Enter the date shipped, the carrier (for example, Federal Express) and the airbill number in the appropriate spaces.

Box No. 5

Ship to:

Enter the name of the CLP laboratory contact (sample custodian) and its full address in the box.

Box No. 6

Preservative:

Box provides a list of commonly-used preservatives. Please enter the appropriate preservative used in column D.

Box No. 7

Sample description:

Box provides a list of the description/matrices of samples that are collected. Please enter appropriate description in column A.

Completing the Form - Sample Documentation

Carefully transcribe the CLP sample number from the printed sample labels on the TR in the space provided.

Complete columns A through G to describe the sample.

Column A, Sample Description

Enter the appropriate sample description code from box 7.

NOTE: Describe TRIP BLANKS as No. 3 "Leachate" in column A; EQUIPMENT BLANKS will be described as No. 4 "Rinsate."

Note: Item 6 "Oil" and item 7 "Waste" are for RAS PLUS SAS projects only. Oily samples or waste samples will not be shipped without making prior arrangements with SMO.

Column B, Concentration

Organic – If sample is estimated to be low or medium concentration, enter "L." When shipping RAS plus SAS high concentration samples (previously arranged with SMO), enter "H."

Inorganic – Enter "L" for low concentration, "M" for medium concentration, and "H" for high concentration (under previous RAS plus SAS arrangement).

NOTE: Ship medium and high concentration organic and inorganic samples in metal cans.

Column C, Sample Type Composite/Grab

Please enter which type of sample was collected.

Column D, Preservative Used

Please enter preservation used (i.e., HCL, NAOH, HNO₃, H₂SO₄) refer to Box 6 or the reference number of the preservation (1-7, N).

Column E, RAS Analysis

Check the analytical fractions requested for each sample, for example, VOAs, SVs, and pesticides are for low/medium concentration organics. Total metals and cyanide are for low/medium concentration inorganics. VOAs, SV/pesticides and Aroclors are for high concentration organics. Metals, cyanide, pH/conductivity are for high concentration inorganic samples.

Note: Either total or dissolved metals can be requested for each individual inorganic sample assigned a unique sample number, but not both analyses.

Column F, Regional Specific Tracking Number or Tag Number

Enter the region specific tracking number or tag number in the space provided.

Column G, Station Location Number

Enter the station location in the space provided.

Column H, Month/Day/Year/Time of Sample Collection

Record the month, day, year, and time in military time (e.g., 1600 hours = 4:00 P.M.) of sample collection.

Column I, Sampler Initials

Enter your initials.

Column J, Corresponding CLP Organic/Inorganic Sample No.

Enter the corresponding CLP sample number for organic or inorganic analysis.

Column K, Designated Field OC

Enter the appropriate qualifier for "Blind" Field QC samples in this column.

Please note that all samples must have a qualifier.

<u>Blind Field OC</u>	<u>Qualifier</u>
Blind Blanks	B
Blind field duplicates	D
Not a QC sample	--

Box Titled, "Shipment for Case Complete (Y/N)"

This should reflect the status of the samples scheduled at a lab for a specific case. When ALL samples scheduled/collected for shipment to a lab for a specific case have been shipped, the case is complete.

Box Titled, "Page 1 of "

Please enter the number of TRs per shipment.

Box Titled, "Sample Used for Spike and/or Duplicate"

Please enter sample used for matrix spike and/or duplicate sample (internal lab QC).

Box Titled, "Additional Sampler Signatures"

Please record any additional sampler signatures you are unable to record in box 2.

Box Titled, "Chain-of-Custody Seal Number"

Sampler should enter the chain-of-custody seal number if applicable.

Box Titled, "Split Samples Accepted/Declined"

Sampler should ask sight owner, PRP, etc. whether they want split samples taken. The split samples are either accepted or declined. Sampler should record their signature if split samples are collected and check the appropriate box.

How and When to Separate and Send Traffic Report/Chain-of-Custody Form Copies

When all paperwork has been completed by the sampler and samples are ready to be shipped, the bottom two copies of the traffic report/chain-of-custody forms should be placed in a plastic bag and taped to the inside of the cooler. The second copy of the traffic report/chain-of-custody form will be returned to the SMO within five days of the sample shipment. The top copy is the regions' copy for their records.

Instructions on the Reverse

Instructions summarizing CLP sample volumes, packaging, and shipment reporting requirements are printed on the back of the TRs.

SHIPPING OF SAMPLES

Samples will be shipped and delivered to the designated laboratory for analysis daily. During sampling and sample shipment, the ES field team leader (or designee) will contact the SMO (Nina Smith, 703/519-1360) to inform them of shipments.

The samples will be shipped in ice chests by an overnight carrier such as Federal Express. The traffic report forms will be placed within the chest, which will be sealed with custody seals and/or tamper-resistant tape. Custody seals will be signed by the sample custodian shipping the samples. The airbill number will be noted on the chain-of-custody form.

SECTION 6

CALIBRATION PROCEDURES AND FREQUENCY

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the EPA-CLP specifications. Calibration of laboratory equipment will be based on approved written procedures. It is the responsibility of the EPA data validators to ensure that the proper calibration protocols specified in the CLP statement of work were used. These calibration procedures and frequencies are included in the EPA Contract Laboratory Program, "Statement of Work for Organic Analysis" (Exhibit E) including revisions through August 1991, and in the EPA Contract Laboratory Program, "Statement of Work for Inorganic Analysis" (Exhibit E) including revisions through September 1991.

Records of calibration, repair, or replacement will be filed and maintained by the designated laboratory personnel performing quality control activities in accordance with EPA-CLP requirements. Calibration records of assigned laboratories will be filed and maintained at the laboratory location where the work is performed and will be subject to QA audit.

SECTION 7

ANALYTICAL PROCEDURES

All analytical procedures will conform to analytical methods specified in the Routine Analytical Services (RAS) contract with the EPA.

As per the EPA-CLP Statement of Work for Organic Analysis (including August 1991 revision), laboratories are required to perform any method specified in Exhibit D for volatile organic compounds (CLP-VOA), semivolatile organic compounds (CLP-SV), and pesticide/PCB compounds (CLP-PEST).

As per the EPA-CLP Statement of Work for inorganic analysis (including September 1991 revision), laboratories are required to perform methods specified in Exhibit D. Metals will be analyzed using the 200 series, CLP-modified, methods as specified in Exhibit D. Cyanide will be analyzed by method 335.2 CLP-modified. Table 7.1 list the methods to be performed during this project under the RAS contract. If methods other than those included in RAS are required, then this QAPP will be amended accordingly.

Table 7.1 Analytical Procedures for USEPA-CLP

Parameters	Method
Organics	
Volatile organics (VOA)	CLP-VOA
Semivolatile organics (BNA)	CLP-SV
Pesticides/PCBs	CLP-PEST
Inorganics	
Cyanides	335.2 CLP-M*
Metals	
Aluminum	202.2 CLP-M or 202.1 CLP-M
Antimony	204.2 CLP-M
Arsenic	206.2 CLP-M
Barium	208.2 CLP-M OR 202.1 CLP-M
Beryllium	210.2 CLP-M
Cadmium	213.2 CLP-M
Calcium	218.2 CLP-M
Chromium	215.1 CLP-M
Cobalt	219.2 CLP-M or 219.1 CLP-M
Copper	220.2 CLP-M or 220.1 CLP-M
Iron	236.2 CLP-M or 236.1 CLP-M
Lead	239.2 CLP-M
Magnesium	242.1 CLP-M
Manganese	243.2 CLP-M or 243.1 CLP-M
Mercury	245.1-CLP-M, 245.2-CLP-M, or 245.5-CLP-M
Nickel	249.2 CLP-M or 249.1 CLP-M
Potassium	258.1 CLP-M
Selenium	270.2 CLP-M
Silver	272.2 CLP-M
Sodium	273.1 CLP-M
Thallium	279.2 CLP-M
Vanadium	286.2 CLP-M or 286.1 CLP-M
Zinc	289.2 CLP-M or 289.1 CLP-M

* CLP-M modified for the Contract Laboratory Program

SECTION 8

DATA REDUCTION, VALIDATION, AND REPORTING

FIELD MEASUREMENT DATA

Field measurements will be made by field geologists and engineers, environmental analysts, and technicians. The following standard reporting units will be used during all phases of the project:

- pH will be reported to 0.1 standard units.
- Specific conductance will be reported to two significant figures below 100 μmhos per centimeter ($\mu\text{mhos}/\text{cm}$) and three significant figures above 100 $\mu\text{mhos}/\text{cm}$.
- Temperature will be reported to the nearest 0.5° Celsius (°C).
- Water levels measured in wells will be reported to the nearest 0.01 foot.
- Soil sampling depths will be reported to the nearest 0.5 foot.

Field data will be validated using different procedures.

- Routine checks will be made during the processing of data – for example, looking for errors in identification codes.
- Checks may be made for consistency with parallel data sets (data sets obtained presumably from the same population) – for example, from the same region of the aquifer or volume of soil.

The purpose of these validation checks and tests is to identify outliers, i.e., observations that do not conform to the pattern established by other observations. Outliers may be the result of transcription error or instrumental breakdowns. Outliers may also be manifestations of a greater degree of spatial or temporal variability than expected.

If an outlier is identified, a decision concerning its fate will be rendered. Obvious mistakes in data will be corrected when possible, and the correct value will be inserted. If the correct value cannot be obtained, the data may be excluded. An attempt will be made to explain the existence of the outlier. If no plausible explanation can be found for the outlier, it may be excluded, but a note to that effect will be included in the report. Also, an attempt will be made to determine the effect of the outlier when both included and excluded in the data set.

LABORATORY DATA

The procedures used for calculations and data reduction are specified in each method referenced previously. It will be the responsibility of the laboratory to follow these procedures.

VALIDATION

The laboratory data will be validated by EPA according to the following EPA documents:

- National Functional Guidelines for Organic Data Review (June 1991)
- National Functional Guidelines for Evaluating Inorganics Analyses (July 1988).

REPORTING

The project analytical report from the CLP laboratory will contain data sheets and the results of analysis of QC samples. Analytical reports may also contain the following items:

- Project identification
- Field sample number
- Laboratory sample number
- Sample matrix description
- Date of sample collection
- Analytical method description and reference citation
- Individual parameter results
- Date of analysis (extraction, first run, and subsequent runs)
- Quantitation limits achieved
- Dilution or concentration factors
- Corresponding QC report (including duplicates and spikes).

Matrix interferences on some of the samples, particularly the waste samples, may result in increased detection limits. Matrix interference will be reported as the cause of increased detection limits. These data will be valid.

SECTION 9

INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY

QUALITY ASSURANCE BATCHING

Quality assurance for analytical work on this project will involve analysis of blank samples, spiked samples, and duplicate samples. For each group of 20 samples (or less if fewer than 20 samples are collected) of similar matrix (i.e., groundwater, soil or sediment) collected at each site, analysis will be conducted on one blank, one spiked, and one duplicate spiked sample. Field duplicates will be collected at a rate of 10% for each matrix.

BLANKS, SPIKED BLANKS, AND MATRIX SPIKES

Analysis of blank samples verifies that the analytical method does not introduce contaminants. The spiked blank is generated by addition of standard solutions to the blank water. The matrix spike is generated by addition of standard solutions to a randomly selected field sample. Extra volume of one soil and one water sample will be collected by the field team for matrix spike analyses for samples sent to EACH laboratory.

TRIP BLANKS

Volatile organics samples are susceptible to contamination by diffusion of organic contaminants through the Teflon-lined septum of the sample vial; therefore, a VOA trip blank will be analyzed to monitor for possible sample contamination. The trip blank also serves to detect contaminants in the sample bottles. Each trip blank will be prepared by filling two VOA vials with CLP-specified grade water and shipping the blanks with the sample bottles. Trip blanks accompany the sample bottles through collection and shipment to the laboratory and are stored with the samples. The trip blanks will be analyzed for VOAs. Results of trip blank analyses will be maintained with the corresponding sample analytical data in the project file.

One trip blank will accompany each ice chest containing soil or groundwater samples for VOA analyses. Samples for VOA analysis will be shipped together as practicable.

FIELD DUPLICATES

For samples collected for laboratory analysis, duplicates will be collected at a rate of 10 percent of the total number of samples collected for each medium at each site. The

number of samples collected will be rounded up to the next increment of ten, such that twenty-one samples would require collection of three duplicates.

EQUIPMENT BLANKS

Equipment blanks will be collected to establish that proper sample bottle preparation, decontamination and handling techniques have been employed. One equipment blank may be collected for the groundwater sampling, if bailers are used for sampling, and one blank will be collected for the soil sampling activities at each site. The specific number and type of QA samples at each site will be determined in the SSI work plan. The equipment blanks will be collected prior to the sampling activities. The equipment blank is prepared by collecting CLP-specified grade water from the final rinse of the sampling barrel, split spoon, or sample spoon.

CALIBRATION PROCEDURES AND FREQUENCY

Calibration of field instruments and equipment will be performed at approved intervals as specified by the manufacturer or more frequently as conditions dictate. Calibrations also may be performed at the start and completion of each test run. However, such calibrations will be reinitiated after any delay caused by meals, work shift change, or damage incurred. Calibration standards used as reference standards will be traceable to the NIST, when existent. Standards will be used and duplicate samples analyzed in the field to verify pH and specific conductance data.

SECTION 10

PERFORMANCE AND SYSTEM AUDITS

QA audits may be performed by the project quality assurance manager (QAM) or his designees. Functioning as an independent agent, the QAM or his designee will plan, schedule, and approve system and process audits according to company procedure, customized to specific project requirements. These audits will be implemented to evaluate the capability and performance of project and subcontractor personnel, activities, and documentation of the measurement system(s), including subcontractor activities.

The QAM will be Randy Palachek, who will report directly to the technical director. The QAM will coordinate and monitor the overall QA program, including all onsite activities and the quality control programs of the laboratories. Implementing prompt, effective, and accurate corrective action in response to noncompliance that may occur on projects is absolutely essential in assuring the quality of the end product.

QUALITY SYSTEM AUDIT

A quality system audit refers to a detailed evaluation of the project's quality assurance program to determine its conformance to contractual commitments and standard company procedures. Such an audit includes preparation of formal plans and a checklist based on established requirements. A copy of a field audit checklist is at the end of this section. Audits may be performed on ES and subcontractor work.

AUDIT REPORTS

Audit reports will be written by the QAM or his designee after gathering and evaluating all available data. Items, activities, and documents determined by the QAM or his designee to be noncompliant will be identified at interviews conducted with the involved management. Noncompliant elements will be logged, documented, and controlled through audit findings, which are attached to the audit report. These audit findings are directed to the project manager to resolve the noncompliance satisfactorily in a specified and timely manner.

All audit checklists, audit reports, audit findings, and acceptable resolutions are approved by the QAM prior to issue. QA verification of acceptable resolutions may be determined by reaudit for documented surveillance of the item or activity. Upon verification acceptance, the QAM will close out the audit report and findings.

It is the project manager's overall responsibility to ensure that all corrective actions to resolve audit findings are acted upon promptly and satisfactorily by project personnel.

Field Audit Checklist

Project No. _____ Date _____

Project Location _____ Auditor _____

Signature _____

Yes _____ No _____

1) Has a sampling manager been appointed?

Comments _____

Yes _____ No _____

2) Was a site-specific health and safety plan prepared?

Comments _____

Yes _____ No _____

3) Was the site-specific health and safety plan approved by the project manager and health and safety officer?

Comments _____

Yes _____ No _____

4) Was the site-specific work and safety plan signed and dated to document the approval?

Comments _____

Yes _____ No _____

- 5) Was a briefing held for project organization?
Did each participant read the entire quality assurance project plan?

Comments _____

Yes _____ No _____

- 6) Were additional instructions given to project participants?

Comments _____

Yes _____ No _____

- 7) Is there a list of accountable field documents checked out to the sampling manager?

Comments _____

Yes _____ No _____

- 8) Are samples collected in the types of containers specified in the project work plan or as specified in the standard operating guidelines?

Comments _____

Yes _____ No _____

- 9) Are samples collected as stated in the project work plan?

Comments _____

Yes _____ No _____

- 10) Are samples preserved as specified in the project work plan?

Comments _____

Yes _____ No _____

11) Are the number, frequency, and type of samples collected as specified in the site-specific work plan or as directed by the sampling manager?

Comments _____

Yes _____ No _____

12) Are the number, frequency, and type of measurements and observations taken as specified in the site-specific work plan or as directed by the sampling manager?

Comments _____

Yes _____ No _____

13) Are samples identified with sample labels?

Comments _____

Yes _____ No _____

14) Are samples listed on a chain-of-custody record?

Comments _____

Yes _____ No _____

15) Is chain of custody documented and sample security maintained in the field?

Comments _____

Yes _____ No _____

16) Were sample packages accompanied by the chain-of-custody record showing identification of contents?

Comments _____

Yes _____ No _____

17) Are photographs documented in logbooks as required?

Comments _____

Yes _____ No _____

18) Have any accountable documents been lost?

Comments _____

Yes _____ No _____

19) Has measuring and test equipment been calibrated to manufacturer specifications?

Comments _____

Yes _____ No _____

20) Were the certified standards calibrations traceable to the National Institute of Standards and Technology?

Comments _____

Yes _____ No _____

21) Is the sampling team familiar with CLP laboratory protocol?

Comments _____

SECTION 11

PREVENTIVE MAINTENANCE

PREVENTIVE MAINTENANCE PROCEDURES

Equipment, instruments, tools, gauges, and other items requiring preventive maintenance will be serviced in accordance with the manufacturer's specified recommendations and written procedures developed by the operators.

SCHEDULES

Manufacturer's procedures identify the schedule for servicing critical items in order to minimize the downtime of the measurement system. It will be the responsibility of the operator to adhere to this maintenance schedule and to arrange any necessary and prompt service as required. Service to the equipment, instruments, tools and gauges shall be performed by qualified personnel.

In the absence of any manufacturer's recommended maintenance criteria, a maintenance procedure will be developed by the operator based on experience and previous use of the equipment.

RECORDS

Logs will be established to record maintenance and service procedures and schedules. All maintenance records will be documented and traceable to the specific equipment, instruments, tools, and gauges. Records produced will be reviewed, maintained, and filed by the operator when equipment, instruments, tools, and gauges are used at the sites. The project QA officer or designee will audit these records to verify complete adherence to these procedures.

SECTION 12

SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA IN TERMS OF PRECISION, ACCURACY, AND COMPLETENESS

Planned procedures used to assess data precision and accuracy are in accordance with 44 FR 69533, "Guidelines Establishing Test Procedures for the Analyses of Pollutants", and appendix III, "Example Quality Assurance and Quality Control Procedures for Organic Priority Pollutants", December 3, 1979. Completeness is recorded by comparing the number of parameters initially analyzed with the number of parameters successfully completed and validated.

PRECISION

Relative percent difference (RPD) is calculated as:

$$RPD = \frac{|x_1 - x_2|}{\bar{x}} \times 100\%$$

where:

x_1 = analyte concentration of first duplicate

x_2 = analyte concentration of second duplicate

\bar{x} = average analyte concentration of duplicates 1 and 2.

ACCURACY

Accuracy is expressed as a percent recovery (PR), calculated by:

$$PR = \frac{(A - B)}{C} \times 100\%$$

where:

A = spiked sample result (SSR)

B = sample result (SR)

C = spike added (SA).

COMPLETENESS

The completeness of the data will be determined by:

$$PC = \frac{N_a}{N_t} \times 100\%$$

where:

PC = percent complete

N_a = number of actual valid results

N_t = number of theoretical results obtainable.

SECTION 13

CORRECTIVE ACTION

The following procedures have been established to assure that conditions adverse to quality – malfunctions, deficiencies, deviations, and errors – are promptly investigated, evaluated, and corrected.

INITIATION OF CORRECTIVE ACTION

When a significant condition adverse to quality is noted at the project site, laboratory, or subcontractor locations, the cause of the condition will be determined and corrective action taken to preclude repetition. All project personnel have the responsibility, as part of normal work duties, to promptly identify, solicit approved correction, and report conditions adverse to quality.

Corrective actions may be initiated at a minimum:

- When predetermined acceptance standards – objectives for precision, accuracy, and completeness – are not attained
- When procedures or data compiled are determined to be faulty
- When equipment or instrumentation is found faulty
- When samples and test results cannot be traced with certainty
- When quality assurance requirements have been violated
- When designated approvals have been circumvented
- As a result of an audit.

PROCEDURE DESCRIPTION

Project management and staff, including field investigation teams, sample control personnel, and laboratory groups, monitor ongoing work performance in the normal course of daily responsibilities.

Following identification of an adverse condition or quality assurance problem, notification of the deficiency will be made to the project manager and senior individual in charge of the activity found to be deficient, along with recommendations for correction.

Following implementation of corrective action, the senior individual in charge will report actions taken and results to the project manager and quality assurance manager.

SECTION 14

QUALITY ASSURANCE REPORT

A summary of all QA activities and findings during the course of this project will be reported to the TWC on a site specific basis with the final site inspection reports. Other project-related quality assurance items and corrective actions will be discussed in the monthly progress reports. These may include the following items:

1. Summary of QA management, including any changes
2. Measures of data quality from the project
3. Significant problems related to work quality, and the status of any corrective actions implemented
4. Results of QA performance audits
5. Results of QA systems audits
6. Assessment of data quality in terms of precision, accuracy, completeness, representativeness, and comparability
7. Quality-assurance-related training
8. An assessment of indicators used in the project.

Appendix D

Site Inspection Checklist

SITE RECONNAISSANCE CHECKLIST

I. General

1. Name and title of site contact.
2. Telephone number.
4. Site address.
3. Mailing address (if different).
4. Name of owner and/or operator.
5. Telephone number.
6. Mailing address.

II. Site History

1. How long has current owner/operator been at site?
2. What were previous uses of site? Who were previous owners?
3. Size of site (acres).
4. Is any other property used that is not contiguous with site?
5. Permits (RCRA, TDH, etc.)
6. Any past spills or other environmental or accident problems.
7. What were previous waste management practices?

III. Current Operations

1. What is currently being done at facility?
2. What are waste management practices?
3. What are hazardous chemical management practices?
4. List major hazardous chemicals/constituents present and past.
5. Discuss sources (e.g., tanks, impoundments, containers, etc.).
6. Number of employees – current, peak.

IV. Source Characteristics

1. Identify type of wastes and quantities disposed of at site.
 - a. Identify source of information.
 - b. Photograph
 - c. Dimension (quantity, volume, area) of waste locations.
 - d. Containment controls (clay cap, clay liner, vegetative cover, etc.)
 - e. Existing data
 - f. Condition/integrity of storage/disposal units.

Site reconnaissance checklist, continued

V. Groundwater Pathway

1. Distance from source to nearest well. Identify name and address of well owner, if possible - and estimate well usage (number of people served, irrigation, supplemental, etc.).
2. Verify wells within range of site. Indicate depth to water for each well and number people served. Identify as many owners and addresses as practically feasible.
 - a. 0-0.25
 - b. 0.25-0.5
 - c. 0.5-1
 - d. 1-2 } *Only if information*
 - e. 2-3 } *is critical and*
 - f. 3-4 } *readily available*
3. Aquifer nearest wells are screened in, and water quality.

V. Soil Exposure Pathway

1. Describe status of site access, fencing, gates, locks, condition of security controls.
2. Describe adjacent land use.
3. Describe offsite runoff patterns.
4. Describe number people with residence, school, or day care on site or within 200 yds.
5. Locate nearest school or day care.
6. Number of workers on site (include maximum number to cover work on site).
7. Identify sensitive environments, (see list end of checklist).
8. Describe any offsite runoff pattern existing at the site.

VI. Air Pathway

1. Estimate number of people within 4 miles 0-¼, ¼-½, ½-1, 1-2, 2-3, and 3-4 miles (city or county records).
2. Shortest distance from source to occupied building.
3. Identify known releases to air.
4. Identify reports of adverse health effects.
5. Identify existence of sensitive environments within 4 miles (see end of checklist for list).

Site reconnaissance checklist, continued

VII. Surface Water Pathway

1. Identify the TWC Basin and Stream Segment where the site is located.
2. Describe surface water quality including: a) average discharge, b) total basin drainage area, c) TWC surface water quality monitoring stations.
3. Are there surface water bodies within 2 miles of the site?
4. Provide sketch of surface water runoff and flow patterns for 15-stream-miles downstream.
5. Identify intakes along surface water route within 15-stream-miles.
6. What is water use at each intake.
7. Identify fisheries along the 15-stream-mile pathway.
8. Identify sensitive environments along the 15-stream-mile pathway (see attached list).
9. Identify downstream recreational uses.
10. Estimate approximate flow rates for each water body within the 15-stream-mile target distance (i.e., < 10 cfs, 10-100 cfs, 100-1,000 cfs, 1,000-10,000 cfs, etc.). Estimate length of each stream segment.
11. Identify the annual rainfall and net rainfall at the site.
12. Is site in flood plain (10 year, 100 year, 500 year).
13. Estimate upgradient drainage area limits (watershed).
14. Draw a sketch of drainage from site to nearest surface water including any other contributing tributaries.
15. Identify recreational uses downstream (15 miles).

Miscellaneous Inquiries

1. Are any additional aerial photographs available depicting site history available?
2. Meteorological data
3. Nearest recreational area? Hospital?
4. Local water supply sources?

Site Sketches to Include

1. Date(s) of visit
2. Well locations (including nearest to site)
3. Storage areas (past and present)
4. UST and above ground storage tanks
5. Waste areas

Site reconnaissance checklist, continued

6. Buildings
7. Access roads
8. Areas of ponded water, or depressions in surface
9. Drainage direction
10. Photograph locations and directions
11. Vegetation and significant landscaped features
12. Any irregular appearance for soil, vegetation, tanks, etc. such as may result from spill, backfill operation, recent dirt moving work, etc.